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FAA INTEGRATED NOISE MODEL USER'S GUIDE

MARCH 1976

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16. Abstract

The FAA Integrated Noise Model (INM) provides a conceptually simple method for characterizing aircraft noise near airports. It includes a determination of the total time that the sound level exceeds six different thresholds, and also the equivalent A-weighted sound level, L_{eq}, and the day-night average sound level, L_{dn}, at a number of points surrounding a particular airport. Evening and nighttime exposures are broken out separately. Thus, several methodologies are integrated into a single model which provides a very complete picture of the noise environment.

The computer program INMPROG is available to calculate all of the above information and to present it in tabular form. Plotter output is also generated, for contours of equal exposures to levels above 85 dBA. Equal L_{dn} contours may be produced instead, at the user's option.

This manual is intended to guide the user of the model through the preparation of data required by this program. A description of the airport and its operations must be assembled onto data forms. A separate chapter specifies the punched card formats, so that the punching of cards is distinct from the collection of data. Technical appendices provide the information required for a computer center to bring up and run the program.

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PREFACE

The FAA disseminates this information on airport noise modeling as an effort to make the results of ongoing research into the topic visible and useful to persons who have an interest and/or a need to conduct aviation noise analyses. This document, in and of itself, does not define FAA policy or establish FAA requirements.

FAA policy and/or requirements for noise analyses in environmental assessments or other purposes will be implemented by agency directives. The development of directives (in this case Agency Orders) in the environmental area is done with substantial intra-agency, interagency, and public coordination. At present, insofar as aviation noise analyses are concerned, two agency orders (1050 and 5050) apply. These orders, (presently under revision) will state the requirements for data and analysis for environmental assessments. The orders do not prescribe computer programs or calculation techniques by which to satisfy the data and analysis requirements. It is hoped, however, that the general availability of models, such as the one presented in this document, will substantially ease aviation noise analyses and, in the process, improve their overall quality. The use of this model, is taught at the FAA Academy in Oklahoma City. The option to use or not use particular computer programs or other computational techniques is an option to be exercised by the analyst. The use of a publicly available program does, however, enhance the standardization of noise data and does ease the burden of proof which may be required by the FAA regarding the efficacy of the techniques selected in particular cases.

The computer program described herein has many characteristics considered desirable by the FAA. The principal features, however, are that it provides a detailed description of the noise environment in terms of duration above selected noise threshold levels(further development of the Aircraft Sound Description System) and other noise metrics (Equivalent Noise Level and Day-Night Noise Level). It is planned that this, and other noise models, will be available within the next year which also include the Noise Exposure Forecast metric (NEF) along with the other information. This has been so indicated in selected charts and/or tables within this report.1/

Inquiries regarding the status of developments in both policy and procedures in aviation noise modeling, as they relate to compliance with FAA program requirements, should be directed to:

Office of Environmental Quality
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591

1/ Further development of models to incorporate NEF calculations is underway. Another version will be available shortly. See:
Wyle Research Report WR 76-16
User's Guide for the Integrated Noise Model
Report No. DOT-TST-76T-13 August 1976

ACKNOWLEDGMENT

The authors would like to acknowledge the assistance of the Project Manager, J. E. Cruz, of the FAA Office of Environmental Quality. The concept of the Integrated Noise Model itself - the multiple thresholds and time-of-day breakdowns, as well as the general format for presenting this information - was formulated by Mr. Cruz.

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1. INTRODUCTION

The FAA Integrated Noise Model (INM) provides a conceptually simple method for characterizing aircraft noise near airports. It includes a determination of the total time that the sound level exceeds certain thresholds, and also the equivalent A-weighted sound level, L_{eq}, and the day-night average sound level, L_{dn}, at a number of points surrounding a particular airport. Thus, several methodologies are integrated into a single model which provides a very complete picture of the noise environment. 1/

The computer program INMPROG is available to provide all of the information required. Times-above-threshold are computed using six different thresholds, from 65 dBA to 115 dBA in 10 dBA increments. In addition to the total exposure per day, the exposures occurring during the more sensitive evening hours (7 P.M. - 10 P.M.) and night hours (10 P.M. - 7 A.M.) are presented separately. The equivalent A-weighted sound level L_{eq}, and the day-night average sound level L_{dn}, are also computed. These are defined in Appendix A.

In addition to this tabular information, a graphical plot is provided. This plot presents the contours of equal exposure duration at levels above 85 dBA. Contours depicting the entire area which may receive 85 dBA exposure, and the areas receiving more than 2 minutes and more than 15 minutes per day in excess of 85 dBA, are normally provided. Other time values may be specified by the user. Crosses identify the locations at which the tabular data are computed. Only points within the outermost 85 dBA contour are included in the tabular output.

An option available to the user provides a plot of L_{dn} contours instead of the equal duration contours described above. If this option is selected, tabular output will be generated for points within the outermost L_{dn} contour. Contours of 65 L_{dn} and 75 L_{dn} are normally provided; other L_{dn} levels may be specified by the user.

Noise data for the common aircraft types are provided within the program. For those aircraft which may be retrofitted to meet FAR-36 requirements, data for both "standard" aircraft and aircraft equipped with quiet nacelles are included. Certain standard operational procedures - specifically takeoffs utilizing ATA procedures at a number of gross weights, and landings with maximum certificated flap settings - are assigned operational codes. These codes access a library of pre-computed

1/ Further development of models to incorporate NEF calculations is underway. Another version will be available shortly. See:
Wyle Research Report WR 76-16
<u>User's Guide for the Integrated Noise Model</u>
Report No. DOT-TST-76T-13 August 1976

noise data available to the program. Other operational procedures may be specified by the user. These cause additional data to be generated on a temporary basis.

The complete program package is available on tape through the SHARE Program Library Agency.*

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* The SHARE Program Library Agency
Triangle Universities Computation Center
P.O. Box 12076
Research Triangle Park, N.C. 27709
(919) 549-0671 Ext. 283

2. COLLECTION OF INPUT DATA

2.1 Overview

The user is required to provide information describing the airport and its associated activity. Four types of input are always required:

a. Runway definitions

b. Track definitions

c. Traffic mix allocation

d. User options (including title)

These are described in the following subsections. Additional input is required only if the user specifies aircraft types or flight procedures not in the standard library. This additional input is discussed in Section 3.

Card formats for actual data entry are presented in Section 5.

The following steps are required in assembling the input data. They are described in detail in the remainder of this manual.

a. Select a reference point or origin.

b. Define runways (Data Form #1).

c. Define flight tracks - takeoff and landing (Data Form #2). This includes description in terms of track segments.

d. Obtain total traffic mix by aircraft type, gross weight, and operational procedure (Data Form #3). Obtain breakdown by time of day. Add the numbers of each aircraft type to obtain totals.

e. Allocate traffic mix by flight track (Data Form #4). Maintain day/evening/night breakdown. Add all entries to obtain totals as check.

f. Enter title and other user options (Data Form #5).

g. If user-defined operational procedures are to be used, obtain profile data, including thrust settings and aircraft speed (Data Form #6).

h. If user-defined acoustic data will be used, enter these (Data Form #7).

i. Check all data.

j. Transfer to coding sheets, punched cards, or disk storage.

2.2 Preliminary Steps

The first step in preparing data for input is the selection of a reference point or origin from which to measure the runway locations. The location of this origin is arbitrary, but it should generally be chosen within the airport boundary to avoid loss of precision during computation. It is customary to locate this point at one end of one runway.

The y-axis always points true north, and the x-axis true east. These axes should be marked on the maps being used, to aid in obtaining runway coordinates and orientations. Positive x values correspond to points to the right (east) of the origin; negative x values, to points to the left (west). Positive y values lie above the origin (north); negative y values lie below (south).

All orientations and bearings are measured in degrees clockwise from the y-axis, i.e., relative to true north (not magnetic north). This is desirable in order that the plotter output line up with standard map orientations. It is therefore the user's responsibility to ascertain if any of his data is initially given relative to magnetic north (e.g., VOR radials) and to perform the conversion to true north.

All distances must be given in feet.

Users are frequently concerned with the precision (number of significant digits) of their data. It is not necessary to be overly precise. Horizontal distances such as runway coordinates and lengths, and track segment lengths and radii, may be rounded to the nearest 100 feet. Bearings and orientations should be given to the nearest degree. Traffic mix data should be given to two significant digits; in other words, roundoff errors of a few percent are not considered significant.

2.3 Runway Definitions

Up to 50 distinct runway identifiers can be handled by the INMPROG computer program. Where both ends of a runway are to be

identified (e.g., Runway 18/36), it is sufficient to supply data for one end only; the program will compute the other end.

Data Form #1 (Figure 2-1) requests the necessary information. The runway identifier (column 1) consists of up to four non-blank characters. Generally, standard runway designations are used. Where a runway is used for operations in both directions, identifiers for both ends, separated by a slash, should be entered (e.g., '18/36', '13R/31L').

The runway orientation (column 2) must be given in degrees relative to true north. Where both ends of a runway are identified, the orientation and coordinates must refer to the first identifier of the pair. The x and y coordinates (in feet) of the runway end are entered in columns 3 and 4. Where a displaced threshold is used, this will be defined in the appropriate track definition (below). The runway length, also in feet, is entered in column 5.

An example is shown in Figure 2-2, with the corresponding data form filled out in Figure 2-3. The origin has been chosen as the north end of Runway 18/36. Note again that the orientations and coordinates refer to the first-named runway of each pair, i.e., Runway 18 for the pair 18/36, and Runway 15 for the pair 15/33. Orientations are measured clockwise from true north (see arrow, Figure 2-2).

The beginning (north end) of Runway 18 is by choice the origin, so x=0 and y=0 have been coded as its coordinates. For Runway 15, its beginning (the northwest end) lies to the left (west) and below (south of) the origin, and so both the x and y coordinates of this point are negative.

2.4 Flight Track Definitions

Flight tracks are the projections along the ground of flight paths. As many as 50 tracks may be defined. Generally several tracks originate (or terminate) at each runway.

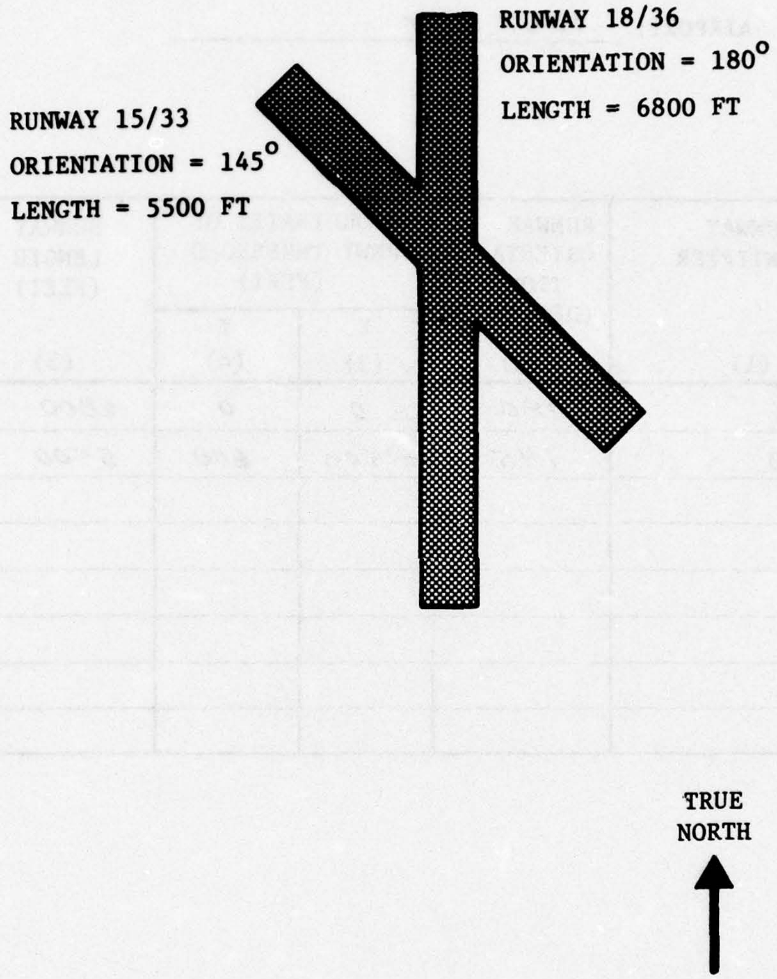
Tracks are divided into segments, each of which is either a straight line or the arc of a circle. There is no limit on the number of segments that can be specified for a track, but

DATA FORM #1 RUNWAY DEFINITIONS

AIRPORT:

RUNWAY IDENTIFIER	RUNWAY ORIENTATION (DEG. TRUE)	COORDINATES OF RNWY THRESHOLD (FEET) X	Y	RUNWAY LENGTH (FEET)
(1)	(2)	(3)	(4)	(5)

FIGURE 2-1
DATA FORM #1



All Angles Measured Clockwise From True North

FIGURE 2-2
SAMPLE RUNWAY LAYOUT

DATA FORM #1 RUNWAY DEFINITIONS

AIRPORT: TEST CITY

RUNWAY IDENTIFIER (1)	RUNWAY ORIENTATION (DEG.TRUE) (2)	COORDINATES OF RNWY THRESHOLD (FEET) X (3)	Y (4)	RUNWAY LENGTH (FEET) (5)
18/36	180	0	0	6800
15/33	145	-1500	-600	5500

FIGURE 2-3
EXAMPLE USING DATA FORM #1

the total explicitly specified for all tracks should not exceed about 120*.

A straight segment of infinite length is generated by the program as the final segment of each takeoff track, or the initial segment of each landing track. Thus, for example, a straight-in landing requires no explicity specified segments.

All tracks are described as flown: takeoff tracks are described from the runway outward, while landing tracks are described inbound toward the runway. Turns (left vs. right) and bearings are also defined as flown. Note also that takeoff tracks start at brake release and include the length of the runway, whereas landing tracks terminate at touchdown and do not include the landing roll. No attempt is made to model thrust reversal; inclusion of thrust reversal would not substantially affect the noise indices outside the airport property.

Data Form #2 (Figure 2-4) is used to define the tracks. This form is divided into a track field followed by four segment fields. (Additional segment fields may be added by the user, as needed.)

The first item in the track field is the track code. This consists of three parts, the runway, a track identifier, and the type (takeoff or landing). The runway (column 1) must be one of the identifiers defined on Data Form #1. The track identifier (column 2) may be any alphanumeric character. It is required in order to distinguish between tracks originating on the same runway. The type (column 3) must be 'T' or 'L', signifying takeoff or landing, respectively. Although the one-character track identifier need not be unique by itself, the three parts (runway, identifier and type) taken together must uniquely specify the track.

The initial bearing is supplied next, in column 4. For takeoff tracks this will agree with the runway orientation. For landing tracks, other than straight in. it will in general be different. Column 5 contains the number of segments to be specifically described. This number does not include the straight segment

---

* 200 locations are actually available in the program; however, one segment per track is generated internally; and certain situations require that the program create additional segment descriptors, which come out of the 200 total available.

DATA FORM #2 TRACK DEFINITIONS

AIRPORT: ______________________________

TRACK FIELD						SEGMENT FIELD 1			SEGMENT FIELD 2		
TRACK CODE			INITIAL BEARING	NUMBER OF SEGMENTS	DISPLACEMENT	SEGMENT TYPE	LENGTH OR RADIUS	FINAL BEARING	SEGMENT TYPE	LENGTH OR RADIUS	FINAL BEARING
RUNWAY (1)	IDENTIFIER (2)	TYPE (3)	(4)	(5)	(6)	(1)	(2)	(3)	(1)	(2)	(3)

TRACK DEFINITIONS

SEGMENT FIELD 2			SEGMENT FIELD 3			SEGMENT FIELD 4		
GMENT TYPE (1)	LENGTH OR RADIUS (2)	FINAL BEARING (3)	SEGMENT TYPE (1)	LENGTH OR RADIUS (2)	FINAL BEARING (3)	SEGMENT TYPE (1)	LENGTH OR RADIUS (2)	FINAL BEARING (3)

FIGURE 2-4
DATA FORM #2

generated by the program at the end of takeoff tracks or the beginning of landing tracks. The final column of the track field, column 6, contains the displacement from the runway threshold of the brake release point (on takeoff), or the nominal touchdown point (on landing). If there is no displacement, 0 must be entered.

The segment fields are filled in next, in the order flown by the aircraft. Three items are required for each segment. The first is the segment type, which may be 'S' (straight), 'TR' (turn right), or 'TL' (turn left). The second item is the length, in the case of straight segments; or the turn radius in the case of curved segments. As usual, these distances must be in feet. The third item is the bearing of the segment in degrees relative to true north. For curved segments, this must refer to the final bearing, at the end of the segment.

An example is shown in Figure 2-5, and the filled-in data form in Figure 2-6. Note that some tracks are navigated in both directions, i.e. on takeoff and landing. These must be defined as separate tracks for the program (e.g. takeoff north from runway 36, landing south into runway 18). Since segments are coded as flown, landings proceed inbound. Landing track 18 SL for example (see Figure 2-5), is flown as a right turn; whereas track 36 NT, which follows the same path but in the opposite direction, is flown as a left turn. Also, the straight segment at the end of 18 SL (landing) does not include the final ground roll (but it does include a 1000 foot displaced landing threshold to approximate the touchdown point); 36 NT (takeoff) begins with the takeoff roll, and does include the full length of the runway.

In several cases in this example, the one-character track identifier was chosen to be 'N' or 'S', representing northbound and southbound tracks respectively. It is more common, however, to use the alphabet in order (A, B, C, D,...). By this means each track may be uniquely identified by a single letter, for example when discussing the output in an environmental impact statement.

Note in the example that the "number of segments" entry corresponds to the number of segment fields actually defined, and that a final straight segment on all takeoffs (or the initial segment on all landings) is assumed but not explicitly defined.

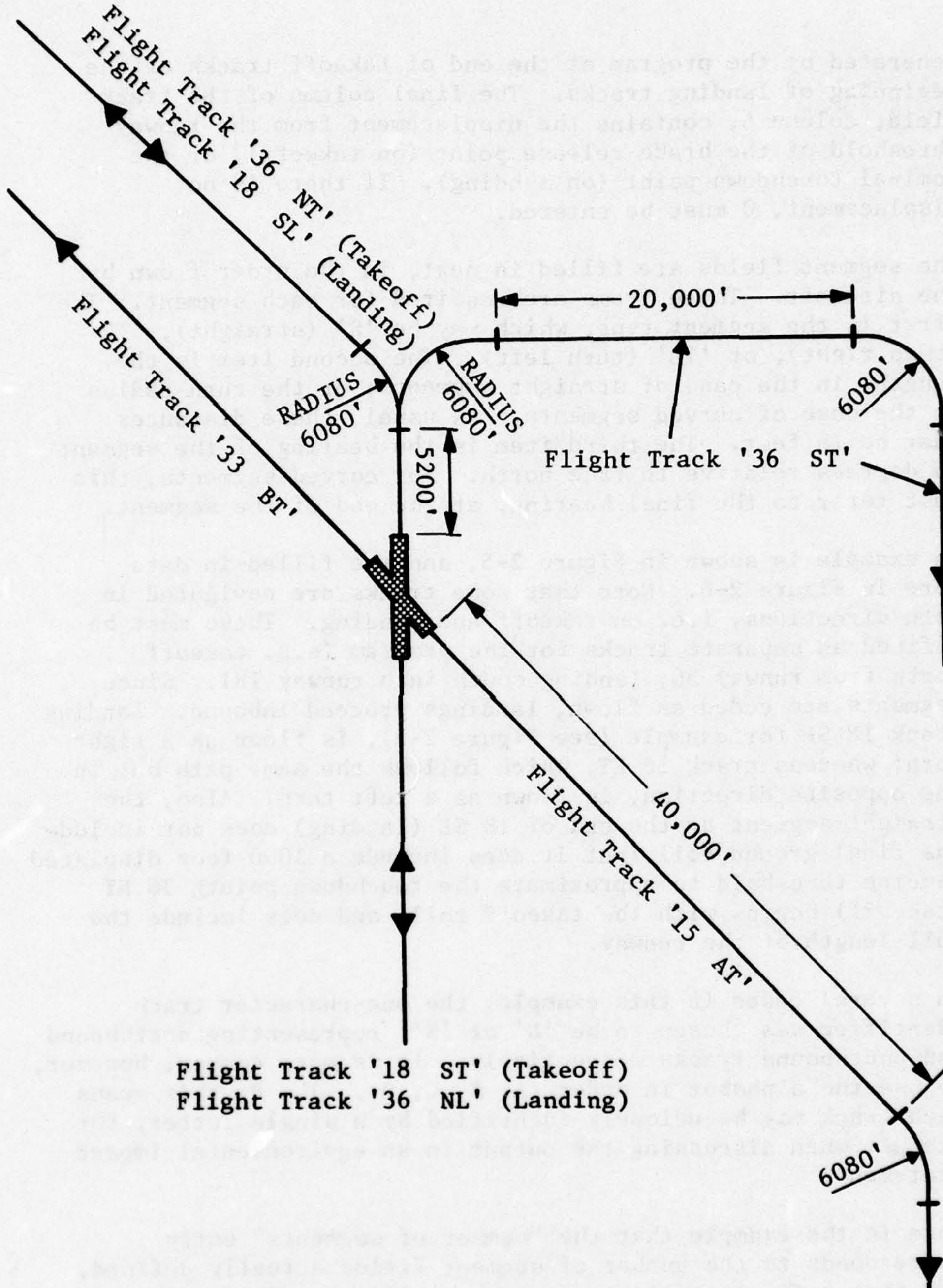


FIGURE 2-5
SAMPLE GROUND TRACK LAYOUT

DATA FORM #2 TRACK DEFINITIONS

AIRPORT: TEST CITY

TRACK FIELD						SEGMENT FIELD 1			SEGMENT FIELD 2			SEGMENT FIELD 3			SEGMENT FIELD 4		
TRACK CODE			INITIAL BEARING	NUMBER OF SEGMENTS	DISPLACEMENT	SEGMENT TYPE	LENGTH OR RADIUS	FINAL BEARING	SEGMENT TYPE	LENGTH OR RADIUS	FINAL BEARING	SEGMENT TYPE	LENGTH OR RADIUS	FINAL BEARING	SEGMENT TYPE	LENGTH OR RADIUS	FINAL BEARING
RUNWAY (1)	IDENTIFIER (2)	TYPE (3)	(4)	(5)	(6)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
18	S	T	180	0	0												
36	N	L	360	0	1000												
36	N	T	360	2	0	S	12,000	360	TL	6080	330						
18	S	L	150	2	1000	TR	6080	180	S	6200	180						
36	S	T	360	4	0	S	12000	360	TR	6080	90	S	20,000	90	TR	6080	180
15	A	T	145	2	0	S	40,000	145	TR	6080	180						
33	B	T	325	0	0												

FIGURE 2-6
EXAMPLE USING DATA FORM #2

Although different aircraft types may fly turns somewhat differently, it is generally necessary to combine aircraft types for the purpose of defining nominal flight tracks flown by all (or most) aircraft types.

For existing airports, nominal flight tracks can be obtained from airport authorities, or from discussions of procedures with the air traffic control personnel. For proposed airports, estimates based on plans, prevailing winds, and major traffic destinations must be made.

For simplicity flight tracks used only in exceptional situations - such that the averaged usage is lower than one flight per day - are generally not defined. Unusual local community situations could dictate otherwise, however.

2.5 Total Traffic Mix

It is necessary to collect information on the aircraft types, weights, and operational procedures used at the airport under study. This information is entered on Data Form #3 (Figure 2-7). Note that this is an intermediate data form, *for the user's convenience*, and is not a part of the required input. Rather, it assembles on one sheet of paper the traffic mix *information* which will be required for subsequent data forms.

The aircraft type (e.g., 'Boeing 727-200') is entered in column 1, and the gross weight (for takeoffs only -- maximum weights are assumed for landings) is entered in column 2. Gross weights are necessarily estimates, and the weights should be rounded off to the values listed (by aircraft type) in Appendix B, Table B-1. The selection provided is more than adequate to assure the required accuracy, and no additional weight classifications need be added by the user. Alternatively, stage length categories may be entered instead of weight, in which case Table B-2 will be used.

Column 3 on the data form provides for identification of the operational procedure - e.g. 'ATA takeoff', 'max. flaps landings', 'NAAP2 approach', 'noise abatement takeoff #2' (a user-defined procedure), etc.

Assuming the weights or stage length classifications have been selected from Tables B-1 or B-2, the following standard

DATA FORM #3　　　TOTAL TRAFFIC MIX

AIRPORT: ______________________　　　SCENARIO: ______________________

AIRCRAFT TYPE	GROSS WEIGHT	OPERATIONAL PROCEDURE	AIRCRAFT CODE		NUMBER OF OPERATIONS DAILY				
			LIBRARY	USER CODE	TOTAL		DAYTIME	EVENING	NIGHT
					TAKEOFF	LANDING			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			TOTALS:						

FIGURE 2-7
DATA FORM #3

procedures may be found in the program's library:

ATA takeoff (air carrier jets)

NBAA takeoff (business jets)

maximum certificated flaps landing, 3^{o} glide slope

For these procedures, the user should enter the aircraft code listed in Table B-1 or B-2 in column 4 of the data form, marked "library". If there is no standard library entry, it becomes necessary for the user to define a four character code of his own and enter it in column 5, "user code". By avoiding codes beginning with the letter "B", the user is assured of avoiding the codes reserved by the program library.

For user-defined procedures, additional operational information must be provided as discussed in Section 3.

The total number of operations per day, of each aircraft type, is entered in column 6 (takeoffs) or 7 (landings) as appropriate. In addition, these totals must be allocated by time of day as daytime (7 A.M. - 7 P.M.); evening (7 P.M. - 10 P.M.), or night (10 P.M. - 7 A.M.). The time of day subtotals are entered in columns 8-10. A sample filled-in form is shown in Figure 2-8.

These traffic mix totals and time of day allocations are generally available from control tower data. Recommended practice is to use a "typical busy day", defined as the average of all weekdays in the busiest three-month period. Air carrier schedules and the Official Airline Guide may be used to supplement tower counts, for air carrier traffic. In many cases the allocation by time of day may be made using across-the-board percentages for all aircraft types. Typically, a few broad categories - international, domestic, business jet, other GA - may be used, with appropriate day/evening/night splits for each category, to provide a very accurate assessment.

In forecasting future operations some uncertainty is of course inevitable, particularly in forecasting the usage of new or substantially modified airports. Judgmental forecasts should wherever possible be backed up by engineering analysis, including simulation or econometric analysis. Where uncertainty exists, no additional loss in accuracy is incurred by combining aircraft into a few representative types.

DATA FORM #3 TOTAL TRAFFIC MIX

AIRPORT: TEST CITY SCENARIO: CURRENT

AIRCRAFT TYPE	GROSS WEIGHT	OPERATIONAL PROCEDURE	AIRCRAFT CODE		NUMBER OF OPERATIONS DAILY				
			LIBRARY	USER CODE	TOTAL		DAYTIME	EVENING	NIGHT
					TAKEOFF	LANDING			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
DC-9-30	80,000	ATA T/O	B209		25	-	20	3	2
DC-9-30	-	max.flaps LDG	B213		-	25	19	3	3
B-727-200	140,000	ATA T/O	B231		30	-	23	4	3
B-727-200	184,000	ATA T/O	B235		20	-	16	3	1
B-727-200	—	max.flaps LDG	B236		-	50	39	7	4
			TOTALS:		75	75	117	20	13

FIGURE 2-8
EXAMPLE USING DATA FORM #3

In general, the user should use his judgement to reduce the number of different aircraft codes. In cases where the number of operations of some aircraft types are small compared to others, the small numbers can be combined into representative types without substantive loss of accuracy.

Finally, as a cross-check, it is recommended that the number of operations of all aircraft types be added up. Total takeoffs must equal total landings; the sum of takeoffs plus landings must equal the sum of total day, total evening, and total night operations.

2.6 Traffic Mix Allocation

The totals developed on Data Form #3, by aircraft/weight/operation, must now be allocated to the various runways and ground tracks defined earlier.

Runway utilization data is generally available from the tower, or can be estimated from wind data and tower procedures. These procedures specify which runways are to be used, in which direction, and for what types of operations. The runway usage patterns are determined not only by air traffic control requirements and aircraft operational requirements, but sometimes also by local considerations, e.g., a preferential runway system that is instituted in order to reduce noise exposure over particularly sensitive locations.

For proposed airports, an estimate must be obtained of runway utilization. Lacking precise knowledge of the runway layout and utilization, the user must make hypotheses about runway information based on expected demand and ATC procedures, predominant winds, and other information that can vary according to local circumstances.

Associated with these runway usage patterns are groups of flight tracks. As with the runway usage patterns, these flight tracks are determined by air traffic control requirements, aircraft operational requirements, and local conditions such as noise abatement routings. As is the case for runways, flight path information must also be hypothesized for proposed airports.

Allocation of operations to the tracks associated with a given runway must generally be estimated from destination data. In

many instances, percent track utilization is applied across the board to all aircraft types (resulting in fractional numbers of operations, which is accepted by the program). However, where restrictions are in effect, due usually to runway length or surface strength; or where differences in runway instrumentation may lead to preferential use by certain classes of aircraft, it may be necessary to assign track utilization by aircraft type. It is also not uncommon for daytime utilization figures to differ from the nighttime figures, due in part to preferential noise-abatement usage during non-busy periods.

Data Form #4 (Figure 2-9) provides for the listing of the final mix allocations. Each line provides for a track code which consists of runway, track identifier, and type, as listed on Form #2, an aircraft code as listed on Form #3, and the number of operations allocated for that combination, for daytime, evening, and nighttime periods respectively.

It may be left to user preference whether to group together all the operations utilizing a single track, or all the tracks used by each aircraft code. Neither grouping is required; the program will sort this data as necessary.

It is again suggested that all operations of all types be added together and the total checked against the totals obtained on Data Form #3.

An example of the completed form, using the tracks and the mix defined in the earlier examples, is given in Figure 2-10.

2.7 User Options

A title may be supplied by the user, and several additional inputs may be specified to alter certain program parameters. These are listed in Data Form #5 (Figure 2-11), together with the standard values (also called "default values") which will be used unless the user specifies otherwise. The desired value need be filled in only if different from the program's standard value.

In general, a title will be desired. This title will appear as a heading on all printed output, and as the title on the

DATA FORM #4 TRAFFIC MIX ALLOCATION

AIRPORT: ______________________ SCENARIO: ______________________

TRACK CODE			AIRCRAFT CODE	NUMBER OF OPERATIONS		
RUNWAY (1)	IDENTIFIER (2)	TYPE (3)	(4)	DAYTIME (5)	EVENING (6)	NIGHTTIME (7)
			TOTALS:			

FIGURE 2-9
DATA FORM #4

DATA FORM #4 TRAFFIC MIX ALLOCATION

AIRPORT: TEST CITY SCENARIO: CURRENT

TRACK CODE			AIRCRAFT CODE	NUMBER OF OPERATIONS		
RUNWAY (1)	IDENTIFIER (2)	TYPE (3)	(4)	DAYTIME (5)	EVENING (6)	NIGHTTIME (7)
18	S	T	B209	7.0	1.05	1.0
36	N	T	B209	7.0	1.05	1.0
15	A	T	B209	3.0	.45	0
33	B	T	B209	3.0	.45	0
18	S	L	B213	9.5	1.5	1.5
36	N	L	B213	9.5	1.5	1.5
18	S	T	B231	7.4	1.4	1.5
36	N	T	B231	7.4	1.4	1.5
15	A	T	B231	3.1	.60	0
33	B	T	B231	3.1	.60	0
36	S	T	B231	2.0	0	0
18	S	T	B235	6.0	1.5	0.5
36	N	T	B235	8.0	1.5	0.5
36	S	T	B235	2.0	0	0
18	S	L	B236	20	3.5	2.0
36	N	L	B236	19	3.5	2.0
			TOTALS:	117.0	20.0	13.0

FIGURE 2-10
EXAMPLE USING DATA FORM #4

DATA FORM #5 USER OPTIONS

AIRPORT: ______________ SCENARIO: ______________

OPTION	DEFAULT VALUE	DESIRED VALUE IF DIFFERENT
TITLE	(blank)	
PLOTTER SCALE	2000 FT/INCH = 1:24000	
BASE	85 dBA THRESHOLD	
CONTOUR LEVELS	0, 2, 15 MINUTES (65,75 L_{dn} if BASE = 'LDN')	
GRID SPACING	3000 FT	
AMBIENT	0 L_{dn}	
AIRCRAFT CODES	LIBRARY ONLY	

FIGURE 2-11
DATA FORM #5

plotter output. The title must be limited to 71 characters including blanks. Capital letters, numbers, blanks, and common punctuation may be used; lower case letters may not be used. When several scenarios of the same airport are to be run - for example with and without a proposed change - the title should specify the scenario as well as the airport, to facilitate matching plotter output with printed output. If no title at all is specified, the computer will simply leave the 'title' space blank.

The contours are generally plotted at 2000 ft/inch. This scale is generally used in the U. S. Geological Survey quadrangle topographic maps, which are readily available. A different scale may be requested for use with different maps, or for other reasons such as display or publication requirements.

A standard 85 dBA noise level threshold is used as the "base" threshold, i.e. the one used for the plotted contours, and the one whose outermost ("0-minute") contour defines the area for further computation. In rare cases - specifically airports with no jet operations - it may be desirable to use 75 dBA as the "base" threshold. No other value may be specified. The user should beware that using 75 dBA as the base threshold, with jet operations present, increases the cost substantially (perhaps by a factor of 5). This is due primarily to the increased area of exposure (more points to compute), plus the increased durations of exposure at each point. Furthermore, the standard noise library may not contain sufficient information to describe correctly the very noisiest jet aircraft at the large distances required to compute a 75 dBA 0-minute contour.

Alternatively, the user may select L_{dn} as the "base" measure, rather than time-above-threshold. In this case the plotted contours will be equal L_{dn} contours, and the outermost L_{dn} contour (normally 65 L_{dn}) defines the area for further computation and tabular output. Note that only one "base" - time-above-threshold or L_{dn} - can be used in a single run.

The contours plotted by default are the "0-minute" (the entire area exposed to 85 dBA, no matter how short the duration), and the 2-minute and 15-minute exposure contours. These selections are based on present experience as representing significant increments in expected community annoyance.

The 0-minute contour would in general be desired, since this defines the area within which further analysis is performed by the program. As many as 5 contours may be requested in addition to the 0-minute; however, more contours tend to clutter the output, and increase the difficulty of discriminating between "holes" (islands of decreased exposure) and "mountains" (increased exposure). Contour levels requested must be in full minutes (no fractions).

In the case where L_{dn} has been selected as the "base", the contours plotted by default are the 65 L_{dn} and 75 L_{dn} contours. These also represent significant increments in expected community reaction.

Again, the user may specify different and/or additional values to be plotted. However, L_{dn} values below 60 cannot be accurately computed with the existing data base (even user-generated data), and for airports with more than 100 daily operations, L_{dn} values below 65 cannot be accurately computed. Generation of L_{dn} contours lower than 65 L_{dn} also increases the cost of running the program substantially.

The standard grid spacing for the tabular output points is 3000 feet. This is a compromise between a desire for a large number of output points, to obtain as complete a picture as possible, and the increased cost of generating more points. The grid spacing may be decreased according to local needs vs. budget constraints. Increasing the spacing may reduce the cost somewhat, but not nearly in proportion to the number of data points.

The ambient noise level is used in the L_{dn} and L_{eq} computations. Ideally, the ambient level at each grid point should be separately entered. This much detail is rarely available, and in most instances would not affect the results anyway. Hence the program is not designed to read an ambient grid. It can, however, read a single level typical of the area. Ambient levels of 40-45 L_{dn} are often used for rural areas, 50 L_{dn} for suburban, and even higher levels for urban communities. Note that the ambient is also expressed as a cumulative L_{dn} level, namely the L_{dn} level which would exist in the absence of aircraft operations.

In general, ambient levels lower than 10 dB below the aircraft-produced L_{dn} may be neglected. Since L_{dn} levels within the 85 dBA contour generally exceed 60, an ambient of 50 or less may be neglected. The program uses a default value of 0, which is clearly negligible. In many cases it may be more pertinent to present the aircraft-produced L_{dn} separately from the L_{dn} due to other sources. This too is facilitated by the 0 default.

The user should of course recognize that the ambient level will be (logarithmically) added to the aircraft noise level. Thus the lowest possible value for the output - zero aircraft noise - is precisely the ambient.

The program library supplies pre-computed noise data for certain standard operating procedures as listed above. If user-defined procedures are also desired (i.e. codes have been selected that are not in the library) this should be noted on Data Form #5. This option is defined in detail in the next section. A completed example of Data Form #5 is shown in Figure 2-12.

DATA FORM #5 USER OPTIONS

AIRPORT: TEST CITY SCENARIO: CURRENT

OPTION	DEFAULT VALUE	DESIRED VALUE IF DIFFERENT
TITLE	(blank)	TEST CITY AIRPORT--CURRENT
PLOTTER SCALE	2000 FT/INCH = 1:24000	1:96000
BASE	85 dBA THRESHOLD	
CONTOUR LEVELS	0, 2, 15 MINUTES (65,75 L_{dn} if BASE = 'LDN')	
GRID SPACING	3000 FT	
AMBIENT	0 L_{dn}	
AIRCRAFT CODES	LIBRARY ONLY	

FIGURE 2-12
EXAMPLE USING DATA FORM #5

3. ALTERNATE NOISE DATA

3.1 Background

The FAA Integrated Noise Model noise library contains flight profile and noise data for a variety of aircraft and operational procedures. This library is sufficient for most applications; the user need only specify aircraft codes of standard library entries to define his traffic mix (cf. Section 2.5). To accommodate the rare instances when the traffic mix includes aircraft and/or operational procedures not covered by the standard library, the model permits the user to generate noise data specifically for his application. The newly generated data is placed in an "alternate noise library"; traffic mix entries can then select data from the alternate library by specifying a code, just as is done with the standard library. Both the standard and the alternate libraries are available to the model and codes referring to the two libraries can be freely intermixed in the traffic mix input.

The ability to create a supplementary noise library is intended primarily to allow the user to specify alternate operational procedures reflecting local conditions. For example, community exposure to noise may be minimized at a given airport by a non-standard cutback procedure on takeoff, or a non-standard approach procedure may be used because a glide slope is set at other than 3 degrees. Library entries describing the noise from such alternate procedures are generated by specifying a profile of the operation and an acoustic data code indicating the aircraft/engine combination. The code is then used to access data on that combination from a standard acoustic data file which is part of the integrated noise model. Occasionally, a user may wish to generate noise data for an aircraft not included in the acoustic data file - a hypothetical future aircraft, for example. In such cases, it is possible to directly input acoustic data curves which relate noise level to engine power and distance from the aircraft.

3.2 Specifying Alternate Noise Library Entries

User inputs to specify alternate noise data include control information, acoustic data for an aircraft, and operational profiles for which noise library entries are to be generated. This section contains a description of these inputs and

presents data forms that can be used to record the required data. The card formats to be used are presented in Section 5.5.

3.2.1 Library Identification

The user may supply a library identifier, which is recorded in the generated alternate noise library. The identifier is included in the printed output from the program. The function of the library identifier is to verify to the user who may have generated several alternate libraries, that the correct one is used in a particular run. If the user fails to specify an identifier, 'USER LIBRARY' is entered in the alternate noise library by default.

The library identifier is entered in the space provided at the top of Data Form #6 (Figure 3-1). This form is also used to specify profile data, as discussed in the next section.

3.2.2 Profile Data

Each profile supplied by the user results in generation of an entry in the alternate noise library. Profile data are entered on Data Form #6 (Figure 3-1). Required data for a profile entry include an aircraft code to identify the entry in the library, a code specifying the acoustic data to be used in generating the entry, an indication of the type of operation being described (takeoff or landing), and a description of the operation in terms of downrange distances, altitudes, engine power settings, and aircraft speeds. Additional parameters are optional; they allow the user to designate the aircraft/engine combination or to insert a short description of the procedure in the library.

a. Aircraft code - This code identifies the noise library entry. The code is taken from the "User Code" column of Data Form #3. The code must be 4 characters in length. Use of codes beginning with the letter 'B' is discouraged, since the standard noise library uses codes beginning with 'B'. Only numbers and upper-case letters may be used.

DATA FORM #6 - PROFILE DATA

Alternate Noise Library Identifier:

Aircraft code ____________

Acoustic data code ____________

Operation (T = takeoff, L = landing) ___

Procedure description (optional) ____________

Aircraft (optional) ____________

Engine (optional) ____________

Power units ____________

Procedure Profile

Downrange	Altitude	Power	Velocity

FIGURE 3-1
DATA FORM #6

b. Acoustic data - This code selects the acoustic data to be used in generating the noise library entry. Table 3-1 gives a list of codes included in the standard acoustic data file. Standard codes may be taken from this table. Alternatively, the acoustic data code may refer to acoustic information directly input by the user (cf. Section 3.2.3).

c. Takeoff/Landing - The user must specify whether the procedure being described is a takeoff or a landing.

d. Procedure Description - This parameter provides a short description of the procedure (up to 20 characters long), for example, "2 SGMT 4.5/3 APPR," or "DEEP CTBCK T/O." This description is taken from the "Operational Procedure" column of Data Form #3. The description is printed in the traffic mix printout from the model.

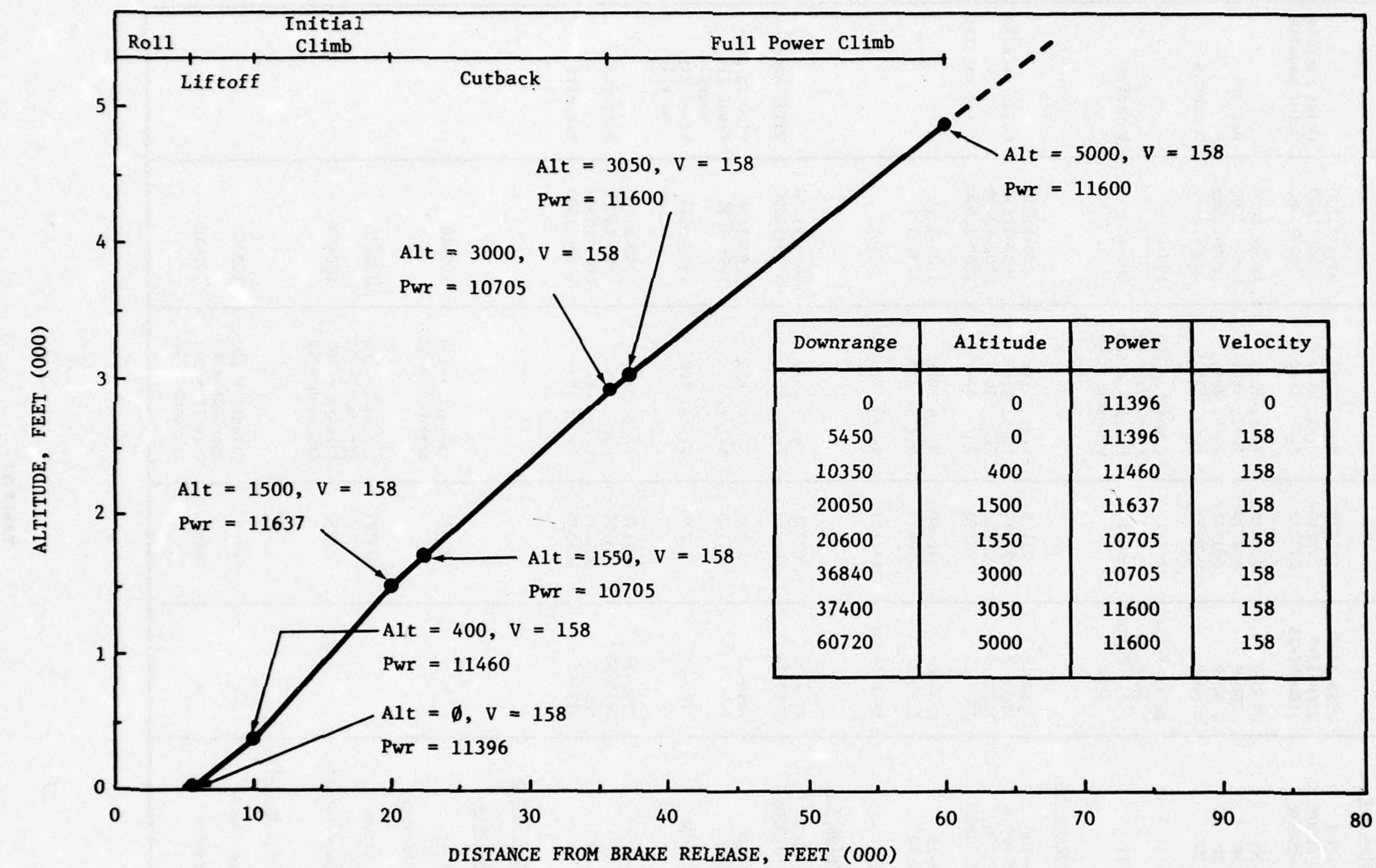
e. Aircraft name - The user may specify the aircraft name to be associated with the procedure. Normally, the aircraft name is extracted from the acoustic data file (or from user-defined acoustic data). However, if the aircraft entered on Data Form #3 differs from the one identified by the acoustic data code, it should be copied to Data Form #6.

f. Engine - The engine parameter is placed in the library entry. As with the aircraft name, if no engine parameter is specified, the default is the engine type given in the acoustic data.

g. Procedure Profile - The procedure profile consists of a series of "procedure points", indicating the aircraft's position, engine power setting, and speed as it flies the procedure. Position is given in feet downrange from brake release (takeoff) or touchdown (landing), altitude in feet, engine power in the units appropriate to the engine (the user must verify the correctness of this value), and indicated airspeed in knots. Fig.3-2 shows a typical takeoff procedure and the procedure profile associated with it. Points must be specified in order of increasing downrange distance; any points out of order will be ignored. Data are

AIRCRAFT	ENGINE	CODE	ENGINE POWER UNITS	ENGINE POWER RANGE	REMARKS
COMMERCIAL TRANSPORTS					
Two Engine Jet					
B-737-200	JT8D-1/-7	73727B	F_N/δ, lbs.	3980-12190	
B-737-200QN	JT8D-1/-7	73727Q	F_N/δ, lbs.	4010-11880	Quiet nacelle
B-737-200QN	JT8D-9/-15	73729Q	F_N/δ, lbs.	4180-13480	Quiet nacelle
DC-9-30	JT8D-7	DC937B	F_N/δ, lbs.	4000-12000	
DC-9-30	JT8D-7	DC937Q	F_N/δ, lbs.	4000-12000	Retrofit
DC-9-30	JT8D-9	DC937B	F_N/δ, lbs.	2000-12500	
DC-9-30	JT8D-9	DC939Q	F_N/δ, lbs.	2000-10500	Retrofit
BAC-111	Rolls Royce Spey	BAC11B	Takeoff = 100 Approach = 40	100-40	
BAC-111	Rolls Royce Spey	BAC11Q	Takeoff = 100 Approach = 40	100-40	Retrofit
Three Engine Jet					
B-727-100	JT8D-1/-7	72711B	F_N/δ, lbs.	3930-11850	
B-727-100QN	JT8D-1/-7	72711Q	F_N/δ, lbs.	3930-11850	Quiet nacelle
B-727-200	JT8D-15	72725B	F_N/δ, lbs.	3500-13050	
B-727-200QN	JT8D-15	72725Q	F_N/δ, lbs.	3800-12800	Quiet nacelle
DC-10-10	CF6-6D	D1016D	$N_1/\sqrt{\theta}$, RPM	2200-3420	
DC-10-40	JT9D-20	D10492	$N_1/\sqrt{\theta}$, RPM	2200-3410	
L-1011	RB-211-22B	L11122	$N_1/\sqrt{\theta}$, Percent	55-95	
Four Engine Jet					
B-707-320B	JT3D-3B	70733B	F_N/δ, lbs.	3630-15250	
B-707-320BQN	JT3D-3B	70733Q	F_N/δ, lbs.	3490-13930	Quiet nacelle
B-747-100	JT9D-3A	74713B	$N_1/\sqrt{\theta}$, RPM	1990-3310	Blow in door
B-747-100	JT9D-7	74717B	$N_1/\sqrt{\theta}$, RPM	1996-3355	Fixed lip nacelle
B-747-200B	JT9D-7	74727B	$N_1/\sqrt{\theta}$, RPM	1996-3355	Fixed lip nacelle
DC-8-61	JT3D-3B	DC813B	F_N/δ, lbs.	3000-15000	
DC-8-61	JT3D-3B	DC813Q	F_N/δ, lbs.	3000-15000	Retrofit
DC-8-63	JT3D-7	DC837B	F_N/δ, lbs.	4000-15800	
DC-8-63	JT3D-7	DC837Q	F_N/δ, lbs.	4000-15800	Retrofit
GENERAL AVIATION					
Business Jets					
Jet Star, Lear Jet, Jet Commander	-	GAJET1	Takeoff = 100 Approach = 40	100-40	
Gulfstream II	-	GAJET2	Takeoff = 100 Approach = 40	100-40	
Cessna Citation	-	GAJET3	Takeoff = 100 Approach = 40	100-40	
Propeller Aircraft					
Single Engine	-	GAPRP1	Takeoff = 100 Approach = 40	100-40	
Two Engine	-	GAPRP2	Takeoff = 100 Approach = 40	100-40	

TABLE 3-1
STANDARD ACOUSTIC DATA FILE CODES



Downrange	Altitude	Power	Velocity
0	0	11396	0
5450	0	11396	158
10350	400	11460	158
20050	1500	11637	158
20600	1550	10705	158
36840	3000	10705	158
37400	3050	11600	158
60720	5000	11600	158

FIGURE 3-2
TYPICAL TAKEOFF PROCEDURE DESCRIPTION

recorded in the noise library file at fixed downrange increments; where necessary, values of downrange distances, altitude, power and speed will be interpolated between user supplied points. Engine power values outside the stored range (Table 3-1) will still be accepted; the program will extrapolate linearly to obtain the noise levels.

Table 3-2 summarizes the profile data inputs. Figure 3-3 shows how Data Form #6 is to be completed, using the profile shown in Figure 3-2 as an example.

Note in particular that the program interpolates linearly from point to point. Thus a power cutback, for example, requires two points to define it: the first defines the end of the full thrust segment, and the second defines the achievement of cutback and its level. These two points are typically less than 1000 feet apart (Figure 3-4). (If the first of these points were omitted, the thrust would be gradually reduced starting at the previous point (typically the liftoff point). This too is illustrated in Figure 3-4).

3.2.3 Acoustic Data

The program uses acoustic data to determine the noise level generated by an aircraft flying a procedure as a function of distance and engine power setting. Acoustic data is the internal representation of noise level curves such as are shown in Figure 3-5. The user need not supply acoustic data; normally, he can select an appropriate code from the standard acoustic data file (cf. Table 3-1 above). The following parameters are used to supply user-defined acoustic data; Data Form #7 (Figure 3-6) is used to record these parameters.

a. Acoustic code - This code identifies the acoustic data. The user indicates the acoustic data that he wishes to use for a generated noise library entry by specifying this code, up to a maximum of six characters. Only numbers and upper-case letters may be used.

b. Aircraft and engine - These parameters identify the aircraft to which the acoustic data applies. They are optional, but should normally be supplied since the aircraft and engine fields in a noise library entry may be picked up from the acoustic data.

TABLE 3-2
ALTERNATE NOISE DATA PROFILE INPUTS

PARAMETER	DEFAULT VALUE	FUNCTION
Noise code	None	Required parameter. Establishes code for new entry to alternate noise library.
Acoustic data code	None	Required parameter. Specifies acoustic data to be used in generating noise library data.
Takeoff/landing	None	Required parameter. Indicates type of operation.
Procedure Description	None	Optional parameter. Short description of procedure
Aircraft name	Aircraft name in acoustic data entry	Optional parameter. Supplies aircraft name to be recorded in library entry.
Engine	Engine in acoustic data entry	Optional parameter. Supplies engine type to be recorded in library entry.
Procedure Profile	None	Required. Describes procedure for which noise library entry is to be generated as a set of "procedure points". Each point specifies downrange distance (feet), altitude (feet), power, and velocity (knots).

DATA FORM #6 - PROFILE DATA

Alternate Noise Library Identifier: USER LIBRARY #1

Aircraft code	C001
Acoustic data code	NEWAC1
Operation (T = takeoff, L = landing)	T
Procedure description (optional)	ATA TAKEOFF
Aircraft (optional)	FUTURE JET
Engine (optional)	HIGH BYPASS
Power units	POUNDS

Procedure Profile

Downrange	Altitude	Power	Velocity
0	0	11396	0
5450	0	11396	158
10350	400	11460	158
20050	1500	11637	158
20600	1550	10705	158
36840	3000	10705	158
37400	3050	11600	158
60720	5000	11600	158

FIGURE 3-3
EXAMPLE USING DATA FORM #6

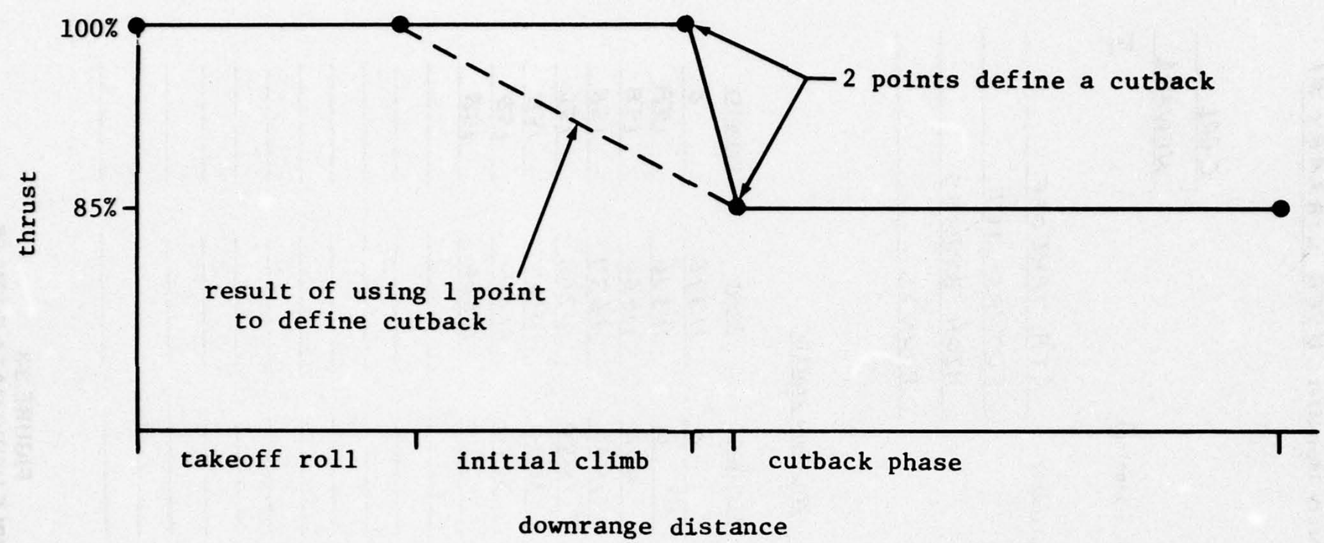


FIGURE 3-4
THRUST PROFILE WITH CUTBACK

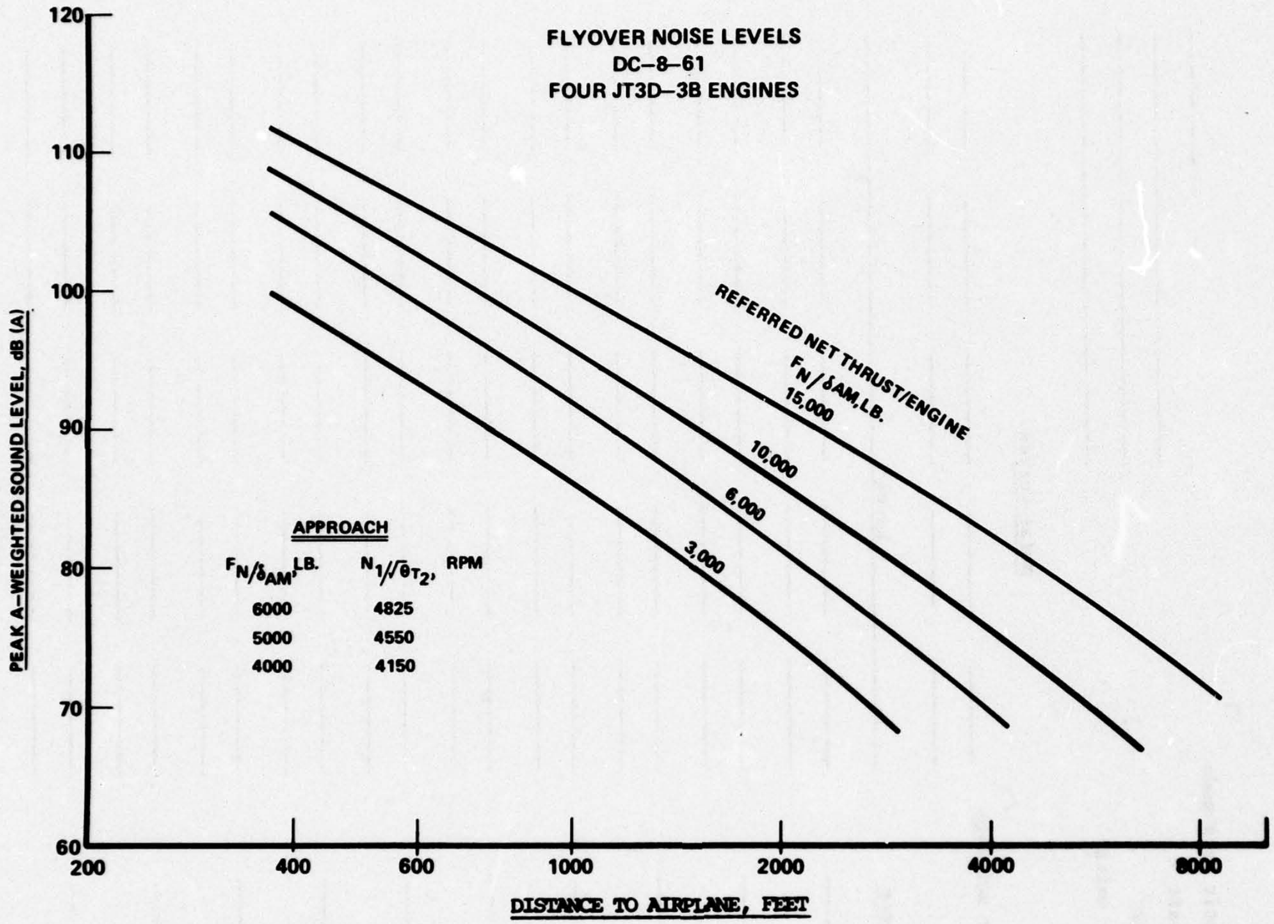


FIGURE 3-5
TYPICAL ACOUSTIC DATA NOISE LEVEL CURVES

DATA FORM #7 - ACOUSTIC DATA

Alternate Noise Library Identifier: ____________________

Acoustic data code ____________

Aircraft ____________________

Engine ____________________

Power units ____________________

Noise Curves

Power settings					

Distance	Level				

FIGURE 3-6
DATA FORM #7

c. Power units - This parameter specifies the units in which thrust is defined. The value of the parameter is used to annotate the output listing; it is not used in any other way by the program.

d. Noise curves - Noise curves define noise levels, in dBA, as a function of slant distance to the aircraft and engine power. To specify the noise curves, the user first supplies the power settings for which curves are being given. He then inputs a distance value and several noise level values (in dBA), each value giving the noise level associated with a specified power setting at that distance. 1/

Table 3-3 summarizes the acoustic data inputs.

As an example of how Data Form #7 is to be completed, consider Figure 3-7. Vertical lines are drawn at selected slant distance to the aircraft values, in this case 400, 600, 1000, 2000, 4000, and 8000 feet. The intersections between this line and the noise curves for various engine power settings are the values that must be inserted in the form. The completed Data Form #7 (Figure 3-8) shows the engine power values corresponding to the curves inserted in the power settings fields. For each distance, the noise level in dBA is entered below the corresponding power settings.

1/ Development of models to incorporate NEF calculations is underway. Another version will be available shortly. See:
Wyle Research Report WR 76-16
User's Guide for the Integrated Noise Model
Report No. DOT-TST-76T-13 August 1976

TABLE 3-3
ALTERNATE NOISE DATA ACOUSTIC INPUTS

PARAMETER	DEFAULT VALUE	FUNCTION
Acoustic code	None	Required parameter. Specifies code by which acoustic data will be referred to.
Aircraft	None	Optional parameter. Specifies aircraft described by acoustic data.
Engine	None	Optional parameter. Specifies engine described by acoustic data.
Thrust units	'LBS'	Optional parameter. Specifies units in which engine thrust is expressed.
Noise curves	None	Required. Specifies acoustic data.

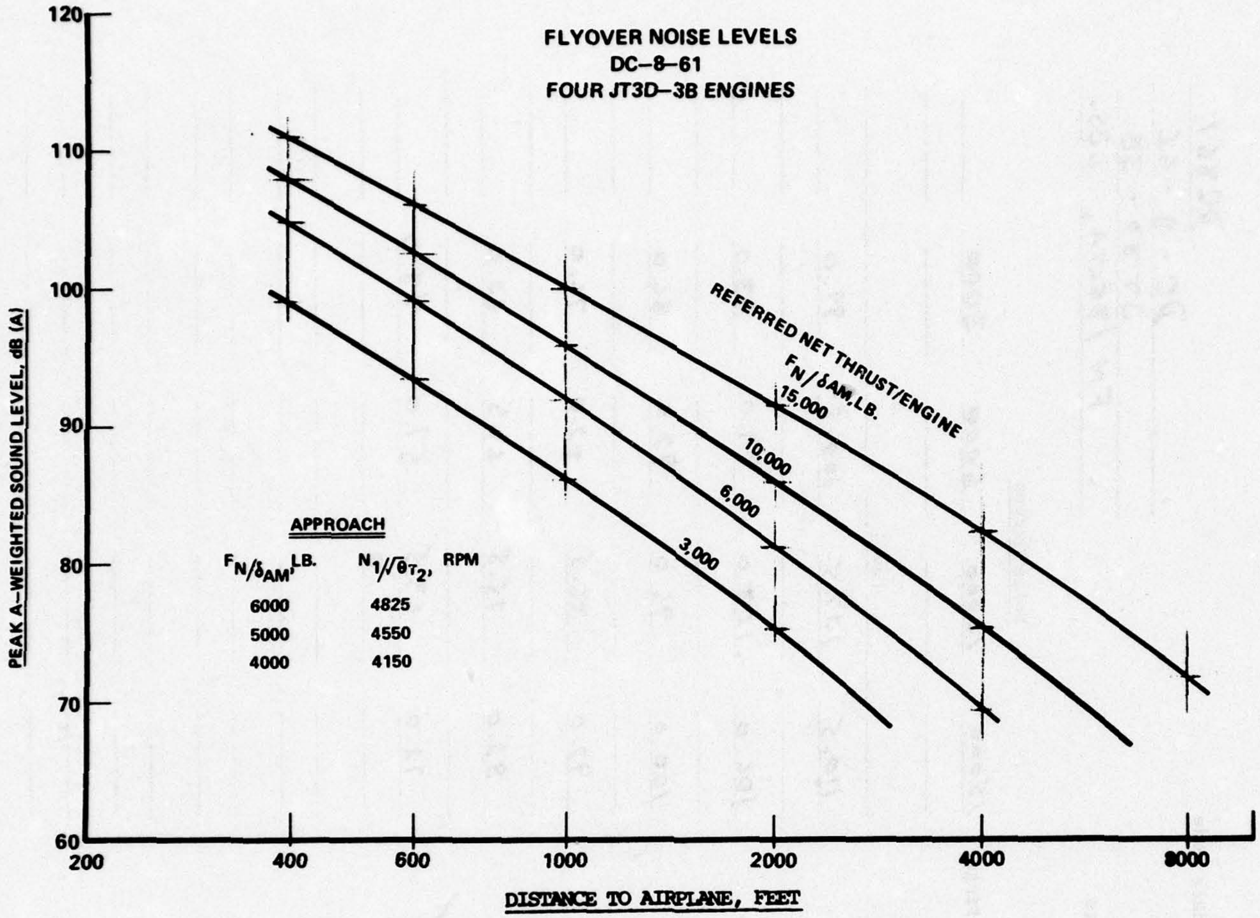


FIGURE 3-7
SPECIFYING NOISE LEVEL AND DISTANCE DATA

DATA FORM #7 - ACOUSTIC DATA

Alternate Noise Library Identifier: USER LIBRARY #1

Acoustic data code: DC861

Aircraft: DC-8-61

Engine: JT3D-3B

Power units: FN/DELTA, LBS.

Noise Curves

Distance	Power settings 15000	10000	6000	3000	
	Level				
400	110.5	107.5	104.5	99.0	
600	106.0	103.0	99.0	93.0	
1000	100.0	96.0	92.0	86.0	
2000	92.0	86.5	82.0	76.0	
4000	82.0	75.5	69.5	62.0	
8000	72.0	63.5	57.0	48.0	

FIGURE 3-8
EXAMPLE USING DATA FORM #7

4. OUTPUT

The program output includes a reflection of the input data as well as the plotted contours and tabulations of the computed noise measures. The four types of required input data are processed by the program, and are then printed out again in a somewhat different form. Examination of this output should indicate that the program has interpreted the input data correctly. Figures 4-1 through 4-4 show the output generated by the input examples of Section 2. The user options (Figure 4-1) appear first, followed by the runway definitions (Figure 4-2), the track definitions (Figure 4-3), and the traffic mix allocation (Figure 4-4).

Certain errors can be detected by the program - for example an aircraft code in the traffic mix allocation which does not appear in either the standard library or the user-defined library. In such cases an explanatory message is printed and the program is terminated before computation begins.

The plotted output and the computed noise measures generated by the example used in Section 2 are presented in Figures 4-5 through 4-7. The plotted output (Figure 4-5) includes the runways and flight tracks. This also allows additional verification that the program has interpreted the input data as intended. The grid points within the outermost contour are indicated by '+' marks, and rows and columns are identified with letters and numbers, respectively. A special diamond shaped symbol marks the reference point x=0, y=0. (In running several scenarios of the same airport, the grid letters and numbers will match, providing the same reference point and grid size have been selected).

Note that only points within the outermost contour are tabulated in the exposure table (Figure 4-6). Outside this region there is too much uncertainty, due both to flight path variations and to variability in the propagation of sound over large distances, to compute reliable data. Also, since noise levels do not exceed 85 dBA (or 65 L_{dn}, for the base = L_{dn} option), the noise exposures due to aircraft would generally be considered less serious.

Each section of the tabular output (Figure 4-6) is identified with a letter-number combination corresponding to a point on the plot within the outermost contour. The x, y coordinates are also listed. Actual geographical information is most easily obtained by overlaying the plotted output on a map of the same

```
FAA INTEGRATED NOISE MODEL VERSION  2 PROGRAM START.


TITLE='TEST CITY AIRPORT--CURRENT';

BASE THRESHOLD =  85 DBA

SCALE= 96000

CONTOURS:    0   2  15 MINUTES.

GRIDSIZE= 3000

AMBIENT=  0 LDN.

DATE OF RUN:  5/19/76
```

FIGURE 4-1
SAMPLE OUTPUT—USER OPTIONS

TEST CITY AIRPORT--CURRENT

RUNWAY	COORDINATES (FEET) EAST	NORTH	ORIENTATION (DEGREES)	LENGTH (FEET)
18/36	0	0	180	6800
15/33	-1500	-600	145	5500

FIGURE 4-2
SAMPLE OUTPUT–RUNWAY DEFINITIONS

TEST CITY AIRPORT--CURRENT

RUNWAY	TRACK ID	OPERATION	SEGMENTS				
			NO.	TYPE	BEARING (DEGREES) INITIAL	BEARING (DEGREES) FINAL	SEGMENT LENGTH/ TURN RADIUS (FEET)
18	S	TAKEOFF	**	STRAIGHT	180	180	INF
36	N	LANDING	**	STRAIGHT	360	360	INF
			****	TOUCHDOWN POINT IS 1000 FEET FROM PUNWAY END.			
36	N	TAKEOFF	1	STRAIGHT	0	0	12000
			2	LEFT TURN	0	330	6080
			**	STRAIGHT	330	330	INF
18	S	LANDING	**	STRAIGHT	150	150	INF
			1	RIGHT TURN	150	180	6080
			2	STRAIGHT	180	180	6200
			****	TOUCHDOWN POINT IS 1000 FEET FROM RUNWAY END.			
36	S	TAKEOFF	1	STRAIGHT	0	0	12000
			2	RIGHT TURN	0	90	6080
			3	STRAIGHT	90	90	20000
			4	RIGHT TURN	90	180	6080
			**	STRAIGHT	180	180	INF
15	A	TAKEOFF	1	STRAIGHT	145	145	40000
			2	RIGHT TURN	145	180	6080
			**	STRAIGHT	180	180	INF
33	B	TAKEOFF	**	STRAIGHT	325	325	INF

FIGURE 4-3
SAMPLE OUTPUT—FLIGHT TRACK DEFINITIONS

TEST CITY AIRPORT--CURRENT

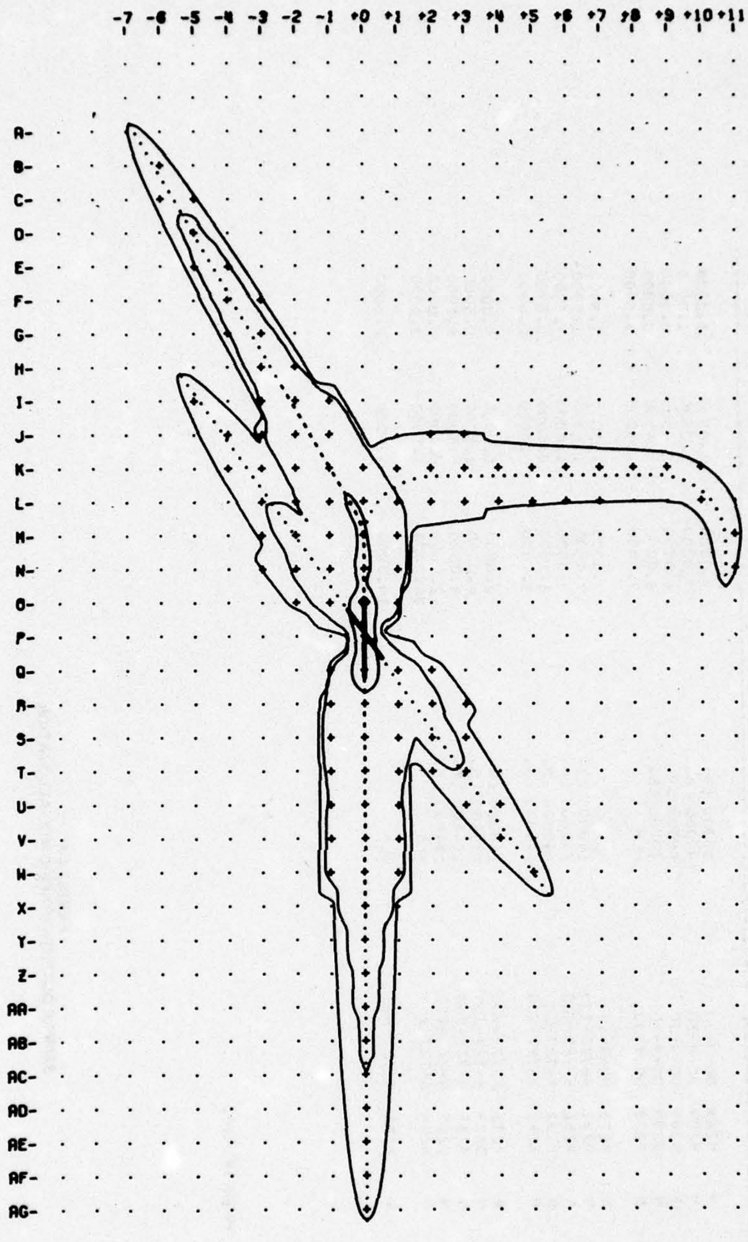
TRACK							NUMBER OF FLIGHTS		
RUNWAY	ID	OPERATION	LIB	CODE	AIRCRAFT	PROCEDURE	DAY	EVENING	NIGHT
18	S	TAKEOFF	N	8209	DC-9-30	80000 LB.	7.0000	1.0500	1.0000
36	N	TAKEOFF	N	8209	DC-9-30	80000 LB.	7.0000	1.0500	1.0000
15	A	TAKEOFF	N	8209	DC-9-30	80000 LB.	3.0000	0.4500	0.0000
33	B	TAKEOFF	N	8209	DC-9-30	80000 LB.	3.0000	0.4500	0.0000
18	S	LANDING	N	8213	DC-9-30	ML*	9.5000	1.5000	1.5000
36	N	LANDING	N	8213	DC-9-30	ML*	9.5000	1.5000	1.5000
18	S	TAKEOFF	N	8231	B-727-200	140000 LB.	7.4000	1.4000	1.5000
36	N	TAKEOFF	N	8231	B-727-200	140000 LB.	7.4000	1.4000	1.5000
15	A	TAKEOFF	N	8231	B-727-200	140000 LB.	3.1000	0.6000	0.0000
33	B	TAKEOFF	N	8231	B-727-200	140000 LB.	3.1000	0.6000	0.0000
36	S	TAKEOFF	N	8231	B-727-200	140000 LB.	2.0000	0.0000	0.0000
18	S	TAKEOFF	N	8235	B-727-200	184800 LB.	6.0000	1.5000	0.5000
36	N	TAKEOFF	N	8235	B-727-200	184800 LB.	8.0000	1.5000	0.5000
36	S	TAKEOFF	N	8235	B-727-200	184800 LB.	2.0000	0.0000	0.0000
18	S	LANDING	N	8236	B-727-200	ML*	20.0000	3.5000	2.0000
36	N	LANDING	N	8236	B-727-200	ML*	19.0000	3.5000	2.0000

TOTAL NUMBER OF FLIGHTS
- DAY 117.0000
- EVENING 20.0000
- NIGHT 13.0000

COMBINED TOTAL 150.0000

FAA INTEGRATED NOISE MODEL PROGRAM END.

FIGURE 4-4
SAMPLE OUTPUT--TRAFFIC MIX ALLOCATION



N

TEST CITY AIRPORT--CURRENT

SCALE = 1:96000   1"=8000'   DATE OF RUN: 03/24/76

CONTOURS: 0 2 15 MINUTE   THRESHOLD=85 DBA.

GRID SPACING IS 3000' BY 3000'

ONE INCH

FIGURE 4-6
SAMPLE PLOTTED OUTPUT

TEST CITY AIRPORT--CURRENT

INTERSECTION	COORDINATES OF INTERSECTION (X,Y)	TIME (MINUTES) ABOVE INDICATED DBA LEVEL							LDN	LEQ	NEF 1/
		PERIOD	65	75	85	95	105	115			
N,+11	33000,3000	24 HR DAY	4.6	1.8	0.0	0.0	0.0	0.0	<55.0	<55.0	
		EVENING	0.0	0.0	0.0	0.0	0.0	0.0			
		NIGHT	0.0	0.0	0.0	0.0	0.0	0.0			
O,-2	-6000,0	24 HR DAY	28.6	3.4	0.9	0.0	0.0	0.0	57.3	57.3	
		EVENING	3.7	0.5	0.1	0.0	0.0	0.0			
		NIGHT	2.3	0.0	0.0	0.0	0.0	0.0			
O,-1	-3000,0	24 HR DAY	71.5	15.8	5.3	0.9	0.0	0.0	70.1	69.1	
		EVENING	9.4	2.1	0.7	0.1	0.0	0.0			
		NIGHT	5.7	1.2	0.4	0.0	0.0	0.0			
O,+0	0,0	24 HR DAY	88.6	47.6	26.3	13.9	6.4	3.2	>90.1	>90.1	
		EVENING	11.6	6.4	3.5	1.9	0.9	0.5			
		NIGHT	7.1	3.9	2.5	1.4	0.6	0.3			
O,+1	3000,0	24 HR DAY	72.3	9.3	2.8	0.0	0.0	0.0	65.9	62.9	
		EVENING	9.4	1.1	0.4	0.0	0.0	0.0			
		NIGHT	5.4	1.2	0.4	0.0	0.0	0.0			
P,+0	0,-3000	24 HR DAY	103.3	52.6	21.3	10.6	3.3	2.3	>90.1	>90.1	
		EVENING	13.4	7.1	2.9	1.4	0.4	0.3			
		NIGHT	8.4	4.1	1.7	0.8	0.3	0.2			
Q,-1	-3000,-6000	24 HR DAY	71.3	8.4	1.0	0.0	0.0	0.0	64.8	61.8	
		EVENING	9.4	1.1	0.1	0.0	0.0	0.0			
		NIGHT	5.9	1.1	0.1	0.0	0.0	0.0			
Q,+0	0,-6000	24 HR DAY	94.7	48.2	28.7	17.4	5.8	3.6	>90.1	>90.1	
		EVENING	12.6	6.3	3.6	2.2	0.8	0.4			
		NIGHT	7.9	4.0	2.6	1.6	0.6	0.3			
Q,+1	3000,-6000	24 HR DAY	72.7	14.9	3.6	1.1	0.2	0.0	71.4	70.9	
		EVENING	9.6	2.0	0.5	0.2	0.0	0.0			
		NIGHT	5.9	1.1	0.1	0.0	0.0	0.0			
Q,+2	6000,-6000	24 HR DAY	24.3	3.6	1.3	0.0	0.0	0.0	58.4	58.4	
		EVENING	3.1	0.5	0.2	0.0	0.0	0.0			
		NIGHT	1.6	0.0	0.0	0.0	0.0	0.0			
R,-1	-3000,-9000	24 HR DAY	46.8	9.9	3.9	0.0	0.0	0.0	66.7	63.3	
		EVENING	6.1	1.3	0.5	0.0	0.0	0.0			
		NIGHT	4.8	1.3	0.5	0.0	0.0	0.0			
R,+0	0,-9000	24 HR DAY	75.2	33.1	13.4	5.4	1.9	0.3	84.4	81.9	
		EVENING	9.9	4.4	1.9	0.8	0.3	0.1			
		NIGHT	6.4	3.1	1.5	0.6	0.2	0.0			

FIGURE 4-8
SAMPLE OUTPUT--TABULAR DATA

1/ Incorporation of NEF calculations is underway. See footnote on page 3-13.

```
                                        TEST CITY AIRPORT--CURRENT

AREA WITHIN  0 MINUTE CONTOUR =  22437 ACRES.
AREA WITHIN  2 MINUTE CONTOUR =  10766 ACRES.
AREA WITHIN 15 MINUTE CONTOUR =    614 ACRES.

SITUATION INDEX FOR 85DBA THRESHOLD =     78793 ACRE-MINUTES.

CONTOUR PLOTTING PROGRAM END.
```

FIGURE 4-7
SAMPLE OUTPUT—EXPOSURE SUMMARY

scale. Each point in the table of exposures presents the noise values computed at the corresponding point on the plot. For points in between, interpolation or "eyeball averaging" will generally give an indication of the exposures to be expected. Certain points, however, may be atypical and should be excluded from such an average. Of specific concern would be a point on or near a brake release point, because of the low speeds of aircraft at brake release. Similarly, a point directly under a flight track will have substantially higher exposures than points off to the side. Interpretation in this fashion must be left to the user.

Single-number summaries also appear in the printed output (Figure 4-7). The areas enclosed by the plotted contours are listed, as well as the "situation index", a single number representing the overall noise exposure for the area under analysis. This index is a sum of the exposure times (in minutes above the base threshold) for each acre in the area being studied; this sum is expressed in "acre-minutes", and reflects the total noise load without regard to its geographic distribution. The situation index is not computed if the base = L_{dn} option has been selected.

If the user has specified any alternate procedures, printed output from the alternate noise library generation will appear before any other output. This printout (Figure 4-8) simply reproduces the user input file and incorporates messages describing program execution.

```
FILE: NOISLIB  OUTPUT  A

CONTROL
LIBID        USER LIBRARY #1
**** CONTROL DATA PROCESSED

PROFILE      C001,NEWAC1,T
AIRCRAFT     FUTURE JET
ENGINE       HIGH BYPASS
POINT            0        0   11396    0
POINT         5450        0   11396  158
POINT        10350      400   11460  158
POINT        20050     1500   11637  158
POINT        20600     1550   10705  158
POINT        36840     3000   10705  158
POINT        37400     3050   11600  158
POINT        60720     5000   11600  158

CREATING NEW LIBRARY: USER LIBRARY #1
CREATION DATE: 05/27/76
**** PROFILE DATA FOR C001 PROCESSED
```

FIGURE 4-8
SAMPLE OUTPUT—ALTERNATE PROCEDURE DEFINITIONS

5. CODING FORMAT

This section describes the specific formatting required for the input data. It is assumed that the necessary data forms have been filled out, and all that remains is to transfer this data to coding forms and then to punched cards.

Each of the four types of required input becomes a "data set" or "file" which is accessed by the computer program. The program refers to a file by a name called a "ddname". The four required files are:

Runway Definitions	Data Form #1	ddname = RWFILE
Track Definitions	Data Form #2	ddname = TRKFILE
Traffic Mix Allocation	Data Form #4	ddname = MIXFILE
User Options	Data Form #5	ddname = PARMFIL

Note that Data Form #3 is not used directly as input. Rather, it represents an intermediate stage in the preparation of Data Form #4.

In the event the user is defining his own aircraft codes, as described in Section 3, a fifth file must also be prepared:

Alternate Procedure Definitions   Data Forms #6 and #7

ddname = ALTPROC

All data input is coded in standard 80-column card format. Columns 1-10 are reserved for alphanumeric identifiers as indicated. Numerical data is entered beginning in Column 11 or beyond. Blank cards are not allowed.

The importance of manually checking all input data cannot be overemphasized. Errors can result in costly as well as erroneous runs.

Users familiar with remote terminal operations will be able to enter the data from the coding forms in card-image format directly into disk storage files. Other users will have cards punched from the coding forms. Alternatively, either the data forms (together with this section describing formatting) or the coding forms can be sent to a computer service organization for keypunching and data entry.

5.1 Runway Definitions (ddname = RWFILE)

The required information has been assembled on Data Form #1. The runway identifier is coded beginning in card column 1 (see Figure 5-1). Also for runway pairs, the pair identifier (e.g. '18/36') is coded beginning in card column 1, exactly as shown on the data form. No embedded blanks are permitted. The next four numbers - orientation, x, y, and length - are entered in free-form format starting in card column 11. One or more blanks must separate each entry from the next, and no blanks (or commas) are allowed within a single entry. In particular, the minus sign of a negative number must be immediately followed by the number itself. Entries must appear in the correct order, and all four numbers must be present.

The example of Figure 2-3 is shown coded in Figure 5-1. While free-form coding is allowed, the example shows the numbers lined up, for ease in reading and checking the coding forms.

5.2 Track Definitions (ddname = TRKFILE)

Data Form #2 contains the required track information. The runway identifier is coded beginning in card column 1. The track identifier is entered in card column 5, and the type in card column 6 (see Figure 5-2). Note that whenever the runway identifier is less than four characters long, blanks will effectively extend the runway ID to four characters in length. The first six card columns, then, provide a unique six-character identification for the track.

The initial bearing, number of segments, and displacement of runway threshold are entered, in that order, in free-form beginning in column 11. Again, blanks separate the entries, and no blanks (or commas) may appear within an entry. All entries must be present, although they may be zero.

Segment fields are then entered in the same order as they appear on the data form. One segment field may be coded per card, or several may appear on a single card. In no case may any non-blank characters appear in columns 1-10. Beginning with column 11, however, segment fields are entered free-form, with segment type, length or radius, and final bearing forming the three entries for each segment. Blanks separate all entries, and may not appear within an entry. The number of segment fields entered must agree with the number indicated in the track field.

The example of Figure 2-6 is coded in Figure 5-2.

RWFILE - TEST CITY AIRPORT

18/36	180	0	0	6800
15/33	145	-1500	-600	5500

FIGURE 5-1
RWFILE CODING FORM: RUNWAY DEFINITIONS

TRKFILE - TEST CITY AIRPORT

Cols 1–2	Cols 5–6	Cols 11–13	Col 16	Cols 21–24	Cols 26–27	Cols 31–35	Cols 41–43
18	ST	180	0	0			
36	NL	360	0	1000			
36	NT	360	2	0			
					S	12000	360
					TL	6080	330
18	SL	150	2	1000			
					TR	6080	180
					S	6200	180
36	ST	360	4	0			
					S	12000	360
					TR	6080	90
					S	20000	90
					TR	6080	180
15	AT	145	2	0			
					S	40000	145
					TR	6080	180
33	BT	325	0	0			

FIGURE 5-2
TRKFILE CODING FORM: FLIGHT TRACK DEFINITIONS

5.3 Traffic Mix Allocation (ddname = MIXFILE)

Data Form #4 contains the information required for the mix file. Each line in the data form requires one card. The six characters of the track code are entered starting in column 1 exactly as in the track file: The runway code begins in column 1; the track identifier appears in column 5, and the type goes in column 6 (Figure 5-3).

The four character aircraft code is entered beginning in column 11. The number of daytime, evening, and nighttime operations, in that order, are entered free-form in subsequent columns. As usual, blanks are required between the numbers, but must not be used within the numbers. All three numbers are required; zero operations must be indicated with a zero.

The example of Figure 2-10 is shown coded in Figure 5-3. Again, columns were lined up for neat appearance, although this is not required by the program. Note that the standard library codes begin with upper case 'B'; lower case will not be recognized by the program.

5.4 User Options (ddname = PARMFIL)

The non-default options have been entered on Data Form #5. Each change from a default value requires a card of the form:

option = value

The names which the program recognizes are quite specific, however, and each will be discussed in turn. The cards may be in any order. The example of Figure 2-12 is shown coded in Figure 5-4.

5.4.1 Title

The option name is TITLE, and the value is a character string of up to 71 characters counting blanks, and enclosed in apostrophes. For example:

```
TITLE = 'THIS IS AN EXAMPLE -- OF A TITLE'
```

Capital letters, numbers, blanks, and most punctuation may be used. Lower-case letters may not be used. If it is desired to include an apostrophe in the title, two apostrophes must be coded for every one that is to appear. For example:

```
TITLE = 'O''HARE AIRPORT'
```

MIXFILE - TEST CITY AIRPORT - CURRENT

18	ST	B209	7.0	1.05	1.0
36	NT	B209	7.0	1.05	1.0
15	AT	B209	3.0	.45	0
33	BT	B209	3.0	.45	0
18	SL	B213	7.5	1.5	1.5
36	NL	B213	7.5	1.5	1.5
18	ST	B231	7.4	1.4	1.5
36	NT	B231	7.4	1.4	1.5
15	AT	B231	3.1	.60	0
33	BT	B231	3.1	.60	0
36	ST	B231	2.0	0	0
18	ST	B235	6.0	1.5	0.5
36	NT	B235	8.0	1.5	0.5
36	ST	B235	2.0	0	0
18	SL	B236	20	3.5	2.0
36	NL	B236	19	3.5	2.0

FIGURE 5-3
MIXFILE CODING FORM: TRAFFIC MIX ALLOCATION

PARMFIL - TEST CITY AIRPORT - CURRENT

```
TITLE='TEST CITY AIRPORT--CURRENT'
SCALE=96000
```

FIGURE 5-4
PARMFIL CODING FORM: USER OPTIONS

Note that no blanks may appear between the two apostrophes of such a pair.

Column 80 of the title card must be blank.

5.4.2 Plotter Scale

The desired scale must first be expressed as a dimensionless ratio, such as 1:24000. This may often be obtained directly from the map being used. To convert feet per inch to a ratio, multiply by 12. Thus 2000 feet/inch becomes 1:24000; 8000 feet/inch becomes 1:96000. The option is then entered in terms of the ratio as:

SCALE = 96000

(for the example 1:96000). Note that no commas are allowed: 96,000 is not valid. No scale value lower than 6000 (500 feet/inch) will be accepted; the resulting plot size is enormous even at that value. No card is required for the standard scale of 2000 feet/inch.

5.4.3 Base and Threshold Used for Plotted Contours

As stated earlier, the default value of 85 dBA is to be used in nearly all cases. Where the option to use 75 dBA is desired, code

BASE = '75'

Note that the number 75 must be enclosed in apostrophes.

Similarly, to specify L_{dn} as the base measure, code

BASE = 'LDN'

Note that the characters LDN must be upper case (most keypunch machines have only upper case, but remote terminals generally have both upper and lower case). Again these characters must be enclosed in apostrophes. No embedded blanks may appear.

5.4.4 Contours Plotted

As usual, no entries are required for the standard values of 0, 2, and 15 minutes. Up to six contours may be specified; these are entered into an array CONTOUR(n), where n may take

values from 0 to 5. The standard (default) setting is actually:

CONTOUR (0) = 0
CONTOUR (1) = 2
CONTOUR (2) = 15

If it is desired to add a contour - say the 5-minute contour - it is simply necessary to code a card specifying one of the remaining locations in the array (3, 4, or 5). Thus

CONTOUR (3) = 5

would add a 5-minute contour, for a total of four contours. Only integer values (whole number of minutes) will be used in the program.

If instead it is desired to replace a contour, then its place in the array must be reassigned. For example:

CONTOUR (1) = 5

would have the effect of generating a 5-minute contour <u>instead</u> of a 2-minute contour. However, the 0-minute contour may not be replaced.

A standard contour may be eliminated by coding a value of 9999. Thus:

CONTOUR (1) = 9999

has the effect of eliminating the 2-minute contour from the plot.

For the case where the user has selected the BASE = 'LDN' option, the CONTOUR (0) position is not used, and may be ignored by the user. The default setting is reset by the program to be

CONTOUR (1) = 65
CONTOUR (2) = 75

to provide L_{dn} 65 and L_{dn} 75 contours. Additions, replacements, and deletions may be coded by the user in the same manner as described above.

5.4.5 Grid Spacing for Tabular Output

If other than 3000 feet is desired for the grid spacing, enter the desired spacing in feet by coding

GRIDSIZE = 2500

(for 2500 foot spacing). Only multiples of 500 feet are used; other values will be reduced to the next lower multiple of 500. Extreme care is urged, as a small value of the grid spacing can result in prohibitively high computer costs. Values below 1000 feet will not be accepted by the program.

5.4.6 Ambient for L_{dn} and L_{eq}

If other than the default value of 0 L_{dn} is desired, enter this value by coding

AMBIENT = 55

(for example, to use a 55 L_{dn} ambient).

5.4.7 User-generated Aircraft Codes

If user-generated aircraft codes are to be used, code

NEWNOIS = '1'B

starting in column 1 of a new card. There are no embedded blanks.

5.5 Alternate Procedure Library Data File (ddname = ALTPROC)

This file is coded only if an alternate noise library is to be generated. The required data is taken from Data Forms #6 and #7. (The completion of these data forms was discussed in Section 3).

Comments may be inserted at any point in the file. Comment cards are indicated by coding an asterisk ('*') in column 1. Comment cards are completely ignored by the program.

Aside from comment cards, each card contains a keyword in columns 1-10. Additional data may be coded in free format in columns 11-80, depending on the keyword. Except as discussed below for acoustic data, continuation cards are not permitted.

There are two types of keywords, function and parameter. The function keywords are CONTROL, PROFILE, and ACOUSTIC. After reading a function keyword, the program assumes that succeeding cards specify parameters associated with the function, until the next function card is reached. The following sections describe the formats of function and parameter cards.

5.5.1 CONTROL Function

The CONTROL function card contains no data in addition to the keyword CONTROL. It may be followed by a LIBID parameter card, on which is entered (beginning in column 11) the library identification from Data Form #6. In order for the library identifier to be recorded in the alternate noise library, the LIBID card must appear before the first PROFILE card in the file.

5.5.2 PROFILE Function

Three additional parameters must be placed on the PROFILE card, beginning in column 11. These are the aircraft code, acoustic data code, and operation codes from Data Form #6.* The codes may be separated by commas or one or more blanks. The length of the aircraft code is four characters, and of the acoustic data code, six characters. The operation code is one character, T or L. If the user specifies codes longer than the allowed maximum, the codes will be truncated to the proper length with no error indication given.

If the user has entered a procedure description, aircraft, or engine on Data Form #6, these should be entered on PROCDES, AIRCRAFT, and ENGINE cards, respectively, following the PROFILE card. The user-supplied information begins in column 11 and is a maximum of 20 characters in length.

The procedure profile from Data Form #6 is entered on a series of POINT cards, one card for each line in the procedure profile. Up to 20 POINT cards may be coded. The downrange, altitude, power and velocity values are entered in that order beginning in

* If the acoustic data code refers to user-defined acoustic data, the PROFILE card must appear in the file after the referenced ACOUSTIC function data.

column 11. They may be separated by commas or by one or more blanks.

Figure 5-5 shows a coding form for the CONTROL and PROFILE functions. The information used to fill out the coding form is taken from the sample Data Form #6 shown in Figure 3-3.

5.5.3 ACOUSTIC Function

The ACOUSTIC function card must contain an acoustic data code from Data Form #7 beginning in or after column 11. The acoustic data code is a maximum of six characters in length. If a longer code is specified, it is truncated to six characters with no error indication. Embedded blanks are not permitted in the acoustic data code. ACOUSTIC data must appear in the file before any PROFILE cards that refer to the defined acoustic data code.

If the user has filled in the aircraft, engine, or power units fields of Data Form #7, the information should be entered on AIRCRAFT, ENGINE, and THRUSTU cards following the ACOUSTIC card. As usual, data should be coded beginning in column 11.

The power settings data from Data Form #7 are entered on a POWER card. The values are entered in a free format, separated by commas or one or more blanks. Up to 10 power setting values may be specified. Power setting data may be continued on to succeeding cards, by coding a hyphen ('-') in column 1 and additional power values beginning in column 11. Columns 2-10 of the continuation card must be blank. A single power setting value cannot be continued on to a succeeding card. For example, if 15 were punched in columns 79-80 of the POWER card and 000 in columns 11-13 of the continuation card, the data would be interpreted as two values, 15 and zero, rather than 15,000.

Distance and level information from Data Form #7 is entered on a series of DIST cards. Up to 10 DIST cards may be coded. Each DIST card contains a distance, in feet, and a number of noise levels, in dBA, corresponding to the noise at the distance for the various power settings entered on the POWER card. The number of levels supplied must equal the number of power setting values. Continuation cards are permitted, using the same format as the POWER cards: a hyphen in column 1 of the continuation card, blanks in columns 2-10, with additional data beginning in column 11. A single noise level value, however, may not be split between two cards.

```
CONTROL
LIBID     USER LIBRARY #1
*
*PROCEDURE FOR HYPOTHETICAL FUTURE JET AIRCRAFT
*
PROFILE   CØØ1,NEWAC1,T
AIRCRAFT  FUTURE JET
ENGINE    HIGH BYPASS
POINT         Ø      Ø  11396    Ø
POINT     5454Ø      Ø  11396  158
POINT     1Ø354    44Ø  1146Ø  158
POINT     24Ø54   154Ø  11631  158
POINT     246ØØ   155Ø  1Ø745  158
POINT     36844   344Ø  1Ø745  158
POINT     374ØØ   345Ø  116ØØ  158
POINT     64724   5ØØØ  116ØØ  158
```

FIGURE 5-5
ALTPROC CODING FORM: CONTROL AND PROFILE FUNCTIONS

An example of how ACOUSTIC data is to be coded is shown in Figure 5-6. The example is based on the sample Data Form #7 of Figure 3-8.

```
*
* ACOUSTIC DATA FOR DC-8-61 AIRCRAFT
*
ACOUSTIC  DC861
AIRCRAFT  DC-8-61
ENGINE    JT3D-3B
THRUSTU   FN/DELTA, LBS.
*
POWER           15ØØØ  1ØØØØ   6ØØØ   3ØØØ
*
DIST        4ØØ 11Ø.5  1Ø7.5  1Ø4.5   99.Ø
DIST        8ØØ 1Ø6.Ø  1Ø3.Ø   99.Ø   93.Ø
DIST       1ØØØ 1ØØ.Ø   96.Ø   92.Ø   86.Ø
DIST       2ØØØ  92.Ø   86.5   82.Ø   76.Ø
DIST       4ØØØ  82.Ø   75.5   69.5   62.Ø
DIST       8ØØØ  72.Ø   63.5   57.Ø   48.Ø
```

FIGURE 5-6
ALTPROC CODING FORM: ACOUSTIC FUNCTION

PRECEDING PAGE BLANK NOT FILMED

APPENDIX A

DEFINITION OF Ldn AND Leq

L_{eq}, the equivalent A-weighted sound level, is that level which, over a 24 hour period, applies the same A-weighted sound energy as the actual time-varying level. Note that the energy is the quantity to be averaged, not the decibel level, which is a logarithm of the energy.

The defining equation of L_{eq} is thus

$$L_{eq}\ (x,y) = 10 \log \frac{1}{T_{day}} \int 10^{dBA(x,y)/10} dt$$

where T_{day} is the number of seconds in a day, 86,400.

L_{dn}, the day-night average sound level, is defined similarly, except that all levels occurring at night (10 P.M. to 7 A.M.) are first increased by 10 dB.

Both of these measures are in current use as community noise indices.*

NEF, the noise exposure forecast,** also has widespread use. Although defined somewhat differently, an estimate of the NEF value can be made by subtracting 35 from the L_{dn} level. This estimate is typically within 2dB of the actual NEF value.

---

* "Impact Characterization of Noise", EPA report NTID 73.4, 1973; "Information on Levels of Environmental Noise", March 1974, EPA #550/9-74-004; U.S. Environmental Protection Agency, Washington, D.C.

** Galloway, W. J. and Bishop, D. E., "Noise Exposure Forecasts: Evolution, Evaluation, Extensions and Land Use Interpretations", FAA-NO-70-9, August 1970.

APPENDIX B

LIST OF AVAILABLE LIBRARY CODES

Table B-1 lists all the currently available codes provided in the program's noise library. These codes are listed by aircraft type; and within each type, by operational procedures and gross weight.

Table B-2 lists aircraft library codes as a function of stage length. This is not as fine a breakdown as Table B-1, but generally provides sufficient accuracy. Its format is often more convenient; furthermore, finer classifications are often not available, or are uncertain to the point of being not meaningful.

Table B-3 lists, by aircraft type, the sources of noise and performance data which were used in generating the program's library.

TABLE B-1
LIST OF AVAILABLE AIRCRAFT TYPE CODES

AIRCRAFT TYPE	OPERATION	GROSS WEIGHT	AIRCRAFT CODE
AIR CARRIER TYPE AIRCRAFT			
TWO ENGINE PROP			
Convair 580	Takeoff	Typical	B011
	Landing	Maximum landing weight	B012
TWO ENGINE JET			
Boeing 737	Takeoff	80,000 lbs.	B200
	Takeoff	90,000 lbs.	B201
	Takeoff	100,000 lbs.	B202
	Takeoff	109,000 lbs. (Maximum takeoff weight)	B203
	Landing	98,000 lbs. (Maximum landing weight)	B204
Boeing 737 - Quiet Nacelle	Takeoff	80,000 lbs.	B296
	Takeoff	90,000 lbs.	B297
	Takeoff	100,000 lbs.	B298
	Takeoff	109,000 lbs. (Maximum takeoff weight)	B299
	Landing	98,000 lbs. (Maximum landing weight)	B300
DC-9-10	Takeoff	70,000 lbs.	B205
	Takeoff	80,000 lbs.	B206
	Takeoff	90,800 lbs. (Maximum takeoff weight)	B207
	Landing	81,700 lbs. (Maximum landing weight)	B208
DC-9-10 - Quiet Nacelle	Takeoff	70,000 lbs.	B301
	Takeoff	80,000 lbs.	B302
	Takeoff	90,800 lbs. (Maximum takeoff weight)	B303
	Landing	81,700 lbs. (Maximum landing weight)	B304
DC-9-30	Takeoff	80,000 lbs.	B209
	Takeoff	90,000 lbs.	B210
	Takeoff	100,000 lbs.	B211
	Takeoff	108,000 lbs. (Maximum takeoff weight)	B212
	Landing	99,000 lbs. (Maximum landing weight)	B213
DC-9-30 - Quiet Nacelle	Takeoff	80,000 lbs.	B305
	Takeoff	90,000 lbs.	B306
	Takeoff	100,000 lbs.	B307
	Takeoff	108,000 lbs. (Maximum takeoff weight)	B308
	Landing	99,000 lbs. (Maximum landing weight)	B309
BAC 1-11	Takeoff	75,000 lbs.	B119
	Takeoff	80,000 lbs.	B120
	Takeoff	87,000 lbs.	B005
	Landing	Maximum landing weight	B006

TABLE B-1 (CONTINUED)

AIRCRAFT TYPE	OPERATION	GROSS WEIGHT	AIRCRAFT CODE
BAC 1-11 - Quiet Nacelle	Takeoff	75,000 lbs.	B123
	Takeoff	80,000 lbs.	B122
	Takeoff	87,000 lbs.	B121
	Landing	Maximum landing weight	B124
THREE ENGINE NARROW BODY JETS			
Boeing 727-100	Takeoff	110,000 lbs.	B237
	Takeoff	120,000 lbs.	B238
	Takeoff	130,000 lbs.	B239
	Takeoff	140,000 lbs.	B240
	Takeoff	150,000 lbs.	B241
	Takeoff	160,000 lbs. (Maximum takeoff weight)	B242
	Landing	142,500 lbs. (Maximum landing weight)	B243
Boeing 727-100 - Quiet Nacelle	Takeoff	110,000 lbs.	B318
	Takeoff	120,000 lbs.	B319
	Takeoff	130,000 lbs.	B320
	Takeoff	140,000 lbs.	B321
	Takeoff	150,000 lbs.	B322
	Takeoff	160,000 lbs. (Maximum takeoff weight)	B323
	Landing	142,000 lbs. (Maximum landing weight)	B324
Boeing 727-200	Takeoff	130,000 lbs.	B230
	Takeoff	140,000 lbs.	B231
	Takeoff	150,000 lbs.	B232
	Takeoff	160,000 lbs.	B233
	Takeoff	170,000 lbs.	B234
	Takeoff	184,800 lbs. (Maximum takeoff weight)	B235
	Landing	154,500 lbs. (Maximum landing weight)	B236
Boeing 727-200 - Quiet Nacelle	Takeoff	130,000 lbs.	B311
	Takeoff	140,000 lbs.	B312
	Takeoff	150,000 lbs.	B313
	Takeoff	160,000 lbs.	B314
	Takeoff	170,000 lbs.	B315
	Takeoff	184,800 lbs. (Maximum takeoff weight)	B316
	Landing	154,400 lbs. (Maximum landing weight)	B317
THREE ENGINE WIDE-BODY JETS			
Lockheed 1011	Takeoff	300,000 lbs.	B214
	Takeoff	320,000 lbs.	B215
	Takeoff	340,000 lbs.	B216
	Takeoff	360,000 lbs.	B217
	Takeoff	380,000 lbs.	B218
	Takeoff	400,000 lbs.	B219
	Takeoff	430,000 lbs.	B220
	Landing	358,000 lbs. (Maximum landing weight)	B221

TABLE B-1 (CONTINUED)

AIRCRAFT TYPE	OPERATION	GROSS WEIGHT	AIRCRAFT CODE
DC-10-10	Takeoff	320,000 lbs.	B222
	Takeoff	340,000 lbs.	B223
	Takeoff	360,000 lbs.	B224
	Takeoff	380,000 lbs.	B225
	Takeoff	400,000 lbs.	B226
	Takeoff	420,000 lbs.	B227
	Takeoff	440,000 lbs. (Maximum takeoff weight)	B228
	Landing	363,500 lbs. (Maximum landing weight)	B229
<u>FOUR ENGINE NARROW-BODY JETS</u>			
Boeing 707-120B	Takeoff	160,000 lbs.	B244
	Takeoff	180,000 lbs.	B245
	Takeoff	200,000 lbs.	B246
	Takeoff	220,000 lbs.	B247
	Takeoff	240,000 lbs.	B248
	Takeoff	258,000 lbs. (Maximum takeoff weight)	B249
	Landing	190,000 lbs. (Maximum landing weight)	B250
Boeing 707-120B - Quiet Nacelle	Takeoff	160,000 lbs.	B325
	Takeoff	180,000 lbs.	B326
	Takeoff	200,000 lbs.	B327
	Takeoff	220,000 lbs.	B328
	Takeoff	240,000 lbs.	B329
	Takeoff	258,000 lbs. (Maximum takeoff weight)	B330
	Landing	190,000 lbs. (Maximum landing weight)	B331
Boeing 707-320B	Takeoff	190,000 lbs.	B251
	Takeoff	210,000 lbs.	B252
	Takeoff	230,000 lbs.	B253
	Takeoff	250,000 lbs.	B254
	Takeoff	270,000 lbs.	B255
	Takeoff	290,000 lbs.	B256
	Takeoff	310,000 lbs.	B257
	Takeoff	333,600 lbs. (Maximum takeoff weight)	B258
	Landing	247,000 lbs. (Maximum landing weight)	B259
Boeing 707-320B - Quiet Nacelle	Takeoff	190,000 lbs.	B332
	Takeoff	210,000 lbs.	B333
	Takeoff	230,000 lbs.	B334
	Takeoff	250,000 lbs.	B335
	Takeoff	270,000 lbs.	B336
	Takeoff	290,000 lbs.	B337
	Takeoff	310,000 lbs.	B338
	Takeoff	333,600 lbs. (Maximum takeoff weight)	B339
	Landing	247,000 lbs. (Maximum landing weight)	B340

TABLE B-1 (CONTINUED)

AIRCRAFT TYPE	OPERATION	GROSS WEIGHT	AIRCRAFT CODE
Convair 880	Takeoff	140,000 lbs.	B058
	Takeoff	150,000 lbs.	B059
	Takeoff	170,000 lbs.	B060
	Landing	Maximum landing weight	B061
DC-8-30	Takeoff	200,000 lbs.	B055
	Takeoff	220,000 lbs.	B056
	Takeoff	300,000 lbs.	B099
	Landing	Maximum landing weight	B057
DC-8-50	Takeoff	220,000 lbs.	B260
	Takeoff	240,000 lbs.	B261
	Takeoff	260,000 lbs.	B262
	Takeoff	280,000 lbs.	B263
	Takeoff	300,000 lbs.	B264
	Takeoff	325,000 lbs. (Maximum takeoff weight)	B265
	Landing	207,000 lbs. (Maximum landing weight)	B266
DC-8-50 - Quiet Nacelle	Takeoff	220,000 lbs.	B341
	Takeoff	240,000 lbs.	B342
	Takeoff	260,000 lbs.	B343
	Takeoff	280,000 lbs.	B344
	Takeoff	300,000 lbs.	B345
	Takeoff	325,000 lbs. (Maximum takeoff weight)	B346
	Landing	207,000 lbs. (Maximum landing weight)	B347
DC-8-60	Takeoff	220,000 lbs.	B267
	Takeoff	240,000 lbs.	B268
	Takeoff	260,000 lbs.	B269
	Takeoff	280,000 lbs.	B270
	Takeoff	300,000 lbs.	B271
	Takeoff	320,000 lbs.	B272
	Takeoff	340,000 lbs.	B273
	Takeoff	355,000 lbs. (Maximum takeoff weight)	B274
	Landing	258,000 lbs. (Maximum landing weight)	B275
DC-8-60 - Quiet Nacelle	Takeoff	220,000 lbs.	B348
	Takeoff	240,000 lbs.	B349
	Takeoff	260,000 lbs.	B350
	Takeoff	280,000 lbs.	B351
	Takeoff	300,000 lbs.	B352
	Takeoff	320,000 lbs.	B353
	Takeoff	340,000 lbs.	B354
	Takeoff	355,000 lbs. (Maximum takeoff weight)	B355
	Landing	258,000 lbs. (Maximum landing weight)	B356

TABLE B-1 (CONCLUDED)

AIRCRAFT TYPE	OPERATION	GROSS WEIGHT	AIRCRAFT CODE
FOUR ENGINE WIDE-BODY JETS			
Boeing 747-100	Takeoff	550,000 lbs.	B287
	Takeoff	575,000 lbs.	B288
	Takeoff	600,000 lbs.	B289
	Takeoff	625,000 lbs.	B290
	Takeoff	650,000 lbs.	B291
	Takeoff	675,000 lbs.	B292
	Takeoff	700,000 lbs.	B293
	Takeoff	735,000 lbs. (Maximum takeoff weight)	B294
	Landing	564,000 lbs. (Maximum landing weight)	B295
Boeing 747-200B	Takeoff	550,000 lbs.	B276
	Takeoff	575,000 lbs.	B277
	Takeoff	600,000 lbs.	B278
	Takeoff	625,000 lbs.	B279
	Takeoff	650,000 lbs.	B280
	Takeoff	675,000 lbs.	B281
	Takeoff	700,000 lbs.	B282
	Takeoff	725,000 lbs.	B283
	Takeoff	750,000 lbs.	B284
	Takeoff	775,000 lbs. (Maximum takeoff weight)	B285
	Landing	564,000 lbs. (Maximum landing weight)	B286
GENERAL AVIATION TYPE AIRCRAFT			
GENERAL AVIATION JETS			
Lear Jet	Takeoff	13,000 lbs.	B133
	Landing	Maximum landing weight	B144
Jet Commander	Takeoff	17,000 lbs.	B134
	Landing	Maximum landing weight	B141
Gulfstream II (Fan jet)	Takeoff	59,000 lbs.	B135
	Landing	Maximum landing weight	B142
Jet Star	Takeoff	30,000 lbs.	B136
	Landing	Maximum landing weight	B143
Cessna Citation	Takeoff	10,850 lbs.	B140
	Landing	Maximum landing weight	B148
TWO ENGINE PROP			
Typical (e.g. Beech Baron)	Takeoff	5,000 lbs.	B137
	Landing	Maximum landing weight	B145
Cessna 340	Takeoff	5,975 lbs.	B138
	Landing	Maximum landing weight	B146
North American 685	Takeoff	6,750 lbs.	B139
	Landing	Maximum landing weight	B147
ONE ENGINE PROP			
Typical	Takeoff	Takeoff	B370
	Landing	Landing	B371

TABLE B-2
AIRCRAFT TYPE CODES BY STAGE LENGTH

Air Carrier - medium range types	Takeoff: Short (under 500 mi.)	Takeoff: Medium (500-1000 mi.)	Takeoff: Medium-Long (1000-2000 mi.)	Approach
DC-9	B210 (B306*)	B211 (B307)	B212 (B308)	B213 (B309)
727-100	B238 (B319)	B240 (B321)	B242 (B323)	B243 (B324)
727-200	B231 (B312)	B233 (B314)	B235 (B316)	B236 (B317)
737	B200 (B296)	B201 (B297)	B203 (B299)	B204 (B300)
BAC-1-11	B119 (B123)	B120 (B122)	B005 (B121)	B006 (B124)

Air Carrier - long range types	Takeoff: Medium (under 1500 mi.)	Takeoff: Long (over 1500 mi.)	Approach
DC-8-50	B260 (B341)	B263 (B344)	B266 (B347)
707-320B	B252 (B333)	B255 (B336)	B259 (B340)
DC-10-10	B225	B227	B229
L-1011	B218	B220	B221
747-100	-	B293	B295
747-200B	-	B282	B286

General Aviation	Takeoff	Approach
Typical business jets (Commander)	B134	B141
Fanjets (Gulfstream II)	B135	B142
Jetstar	B136	B143
Learjet	B133	B144
Citation	B140	B148
Piston aircraft - single engine	B370	B371
Piston aircraft - twin engine	B137	B145

* Numbers in parentheses refer to versions produced or retrofitted to meet FAR 36 levels

TABLE B-3
SOURCES OF AIRCRAFT NOISE AND PERFORMANCE DATA

Aircraft Type	Source of Noise Information*	Source of Performance Information*
Boeing - 707, 727, 737, 747	Boeing	Boeing, Wyle
DC-8, DC-9, DC-10	McDonnell-Douglas	FAA, Wyle
DC-8, DC-9 retrofit	Extrapolated using Boeing data to estimate improvement due to retrofit	FAA
L-1011	Lockheed	FAA
BAC 1-11	FAA	FAA
business jets	BB+N	HCI
GA-piston	BB+N	Piper

*References

Boeing: B. G. Williams and R. Yates, Aircraft Noise Definition, Report No. FAA-EQ-73-7, 2-5, Prepared for Federal Aviation Administration by Boeing Commercial Airplane Company, December 1973.

BB+N: D. E. Bishop, J. F. Mills, J. M. Beckmann, Sound Exposure Level Versus Distance Curves for Civil Aircraft, Bolt, Beranek & Newman, October, 1974 (for GA jets); D. E. Bishop, A. P. Hays, Handbook for Developing Noise Exposure Contours for General Aviation Airports, Bolt, Beranek & Newman, October 1975 (for GA props).

FAA: Information furnished by the FAA Office of Environmental Quality.

HCI: D. C. Gray, Results of Noise Surveys of Seventeen General Aviation Type Aircraft, FAA-EQ-73-1, Prepared for FAA by Hydrospace-Challenger, Inc., December 1972.

Lockheed: N. Shapiro, et al, Commercial Aircraft Noise Definition: L-1011 Tristar, Report No. FAA-EQ-73-6, Prepared for Federal Aviation Administration by Lockheed California Company, September 1974.

McDonnell-Douglas: J. S. Goodman, et al, Aircraft Noise Definition: Phase 1 - Analysis of Existing Data for the DC-8, DC-9, and DC-10 Aircraft, Report No. FAA-EQ-73-5, Prepared for Federal Aviation Administration by Douglas Aircraft Company, August 1973.

Piper: Owner's Handbook, Piper Cherokee Six, 1973; Pilot's Operating Manual, Piper Aztec E, 1970.

Wyle: C. Bartell, et al, Airport Noise Reduction Forecast, Volume II, DOT-TST-75-4, Prepared for DOT by Wyle Laboratories, October 1974.

APPENDIX C

COST ESTIMATES

The bulk of the cost of running the INMPROG program package is incurred during the involved and repetitive computations which must be performed to obtain the various exposure indices. As a result, it is appropriate to approximate the secondary costs of loading the programs and of producing the plotted output.

Moreover, since landing tracks give rise to contours both shorter and much narrower than those of takeoff tracks, these may be ignored in making a cost estimate.

The principal variable determining the cost of a single run is the <u>number of distinct takeoff tracks</u>.

The number of aircraft types used affects the cost only mildly. However, the size of the largest contour is an important factor. For scenarios in which the largest aircraft are medium-weight 727's, the cost may be only two-thirds of that estimated below for all aircraft types (including 707's and DC-8's).

A rough cost estimate may be obtained by multiplying the number of takeoff tracks plus one by $75-$100. This assumes the program will be run at night to take advantage of the usual differential rate structure and faster computer response.

With the BASE=LDN option, the cost will be double, i.e., $150-$200 per takeoff track.

If several scenarios are run, this cost applies to each scenario separately.

APPENDIX D

SYSTEM REQUIREMENTS

The INMPROG program package is written in PL/I source language, and hence requires a PL/I compiler and associated I/O subroutines to be available on the user's system. Specifically, the PL/I 'REGIONAL(1)' direct access I/O capability is utilized.

Several assumptions regarding hardware storage organization have been made; in particular that 4 characters = 1 word = 1 floating point number = 1 fullword interger = 2 halfword integers = 32 bits. These assumptions were made to achieve efficient input/output. Use of this program on a machine with a different word organization would require a methodical review of the program to change the structures used in I/O and overlay defining.

The program runs easily in 500k bytes of memory, either real or virtual. It may be possible to run in a substantially smaller machine - perhaps 300-400k bytes - if the compiled object code and the system I/O routines are space-efficient.

The standard library must be loaded onto a direct access storage device, and requires nearly 4,000,000 bytes of external storage.* Additional storage is required for user-generated library data. The average user-generated library entry requires 20,000 bytes; it is suggested that double this amount be available.

A direct access scratch file of 200,000 bytes is also required by the program. Two sequential output files are produced, requiring (for example) 200,000 bytes and 50,000 bytes, respectively, and very much dependent on the size of the airport.

The amount of input data is relatively small, seldom requiring more than 200 punched cards (16,000 bytes). These may be stored on disk or included in the jobstream.

The plotted output requires a CALCOMP plotter or CALCOMP-compatible software. The only plotter routines required are PLOT, PLOTS, LINE, and SYMBOL. Note however that the one

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* About 17 cylinders on an IBM 3330 disk.

call to PLOTS (which initializes the plotter) is system-dependent, and may have to be changed to suit the installation.

The plotter width is assumed to be at least 27 inches; this may be changed, if necessary. However, the plotter must be of the drum type, with effectively unlimited length, for all but the smallest plots.

APPENDIX E

PROCEDURE FOR BRINGING UP PROGRAM

The source program supplied on tape consists of 27 separate PL/I procedures (5 main programs and 22 subprograms), plus 5 'copy' files required as macros. These are listed in Table E-1. Together these programs comprise about 5000 card images.

In addition, the standard noise library and a separate acoustic data library are also supplied on the tape. These must be loaded onto a direct access device prior to execution of the program. They are not required for compilation, however.

As mentioned in Appendix D, the call to PLOTS is dependent on the installation and may require modification. This call occurs in the procedure INMPLOT, at about line 212 (sequence number 02120). The supplied call reads

```
CALL  PLOTS (ØEØ, ØEØ);
```

and no buffer space is provided. Further, PLOTS is declared in line 93 (seq. no. 00930) to be

```
ENTRY (BIN FLOAT (21), BIN FLOAT (21));
```

any changes required must of course be made before compilation. If the plotter width is less than 27 inches, the declaration of PLOTTER-HEIGHT (line 100), must also be changed.

A PL/I macro library must be generated from the 5 macro files. These are named FIRSTIN, TRKS, OUTPUT, COSD, and CONST. This library must be made available to the PL/I compiler. (It is no longer needed once compilation is complete.)

The 27 programs must be compiled by the PL/I compiler, using the INCLUDE option. It is assumed that the optimizing compiler will be used for such a long program. In addition, it is recommended that the OPTIMIZE (TIME) option be used to achieve the fastest execution time possible. These two options have been specified on *PROCESS cards within the programs.

It is also suggested that the SOURCE and OFFSET options (or GOSTMT, if storage is not a problem) also be specified by the user. This will facilitate error-tracking in the event of any difficulties.

TABLE E-1

LIST OF MAIN- AND SUB-PROGRAMS

INMII (main computational program)

- STARTUP
- RESET
- TRAX
- GETMIX
- GETNOIS
- PRESCAN
- SCAN
- LINEINT
- INTERP
- CPC
- PUTEXPO
- OUTEXPO
- OUTPUT
- TRKIO
- AIRPORT
- ZEROTRK
- EDGE
- ZEROOUT
- DEFGRID
- MINMAX

NOISLIB (generates user-specified library)

- PRPROF
- LIBPROC

INMPRT (prints tabular data)

PREPLOT (extracts and sorts output contours)

INMPLOT (plots contours)

MACROS (input for preprocessor)

- FIRSTIN
- TRKS
- COSD
- CONST
- OUTPUT

Certain 'informatory' and 'warning' messages will be generated by the compiler, and do not signify any difficulty. 'Error' and 'severe' messages should not occur.

The five main programs may be loaded and run directly, or load modules may be generated. These five main programs are named

INMII
NOISLIB
INMPRT
PREPLOT
INMPLOT

At load time, and again at execution time, the appropriate PL/I system library (including the I/O routines, etc.) must be made available to the system.

In addition, when loading the plotter program INMPLOT, the library containing the CALCOMP subroutines must also be made available. Since these subroutines are written for a FORTRAN environment (and the PL/I program is expecting this), it may be necessary to specify the main program entry point to the loader.*

At execution time a number of files or data sets must be specified. These include input data, reference (library) data, program output, and scratch space. A list of required files is given in Table E-2, together with a "typical" size given in number of <u>records</u> (not bytes). The files NOISLIB, ACDFILE, and EXPOREG are fixed in size; the rest depend on the size of the airport. The main output file SCNFILE (and the PREPLOT output file INDATA) are roughly proportional to the area enclosed by the contours. The sizes given in the table are taken from the TESTCITY example of Section 2.

Where no user-defined operation codes are to be generated, it is not necessary to run the NOISLIB program, and hence one need not define the files ALTPROC, ACDFILE, LIBFIL, or ALTLIB.

The four user input files to INMII may, if desired, be entered sequentially as part of the job stream. The card formats have

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* For example for IBM's VM/CMS system, the option RESET DMSIBM must be specified in the LOAD command.

TABLE E-2

LIST OF FILES

PROGRAM	ddname	RECORD LENGTH	BLOCK SIZE	SAMPLE NO. OF RECORDS	USE
NOISLIB					
	ALTPROC	80	(cards)	50	User Input (sequential)
	ACDFILE	558	558	50	Acoustic Data (read only direct access)
	LIBFIL	800	800	100 (25 per entry)	Output = User library (sequential)
	SYSPRINT	133	133	100	Printed Output
INMII					
	PARMFIL	80	(cards)	5	User Input (sequential)
	RWFILE	80	(cards)	5	User Input (sequential)
	TRKFILE	80	(cards)	20	User Input (sequential)
	MIXFILE	80	(cards)	100	User Input (sequential)
	NOISLIB	800	800	4500	Standard Library (read only direct access)
	ALTLIB	800	800	100	User Library (read only direct access) Use the LIBFIL generated by NOISLIB
	EXPOREG	4000	4000	48	Scratch Space (direct access)
	SCNFILE	80	800	2000	Output (sequential)
	SYSPRINT	133	133	200	Printed Output
INMPRT					
	SCNFILE	80	800	2000	Input (sequential)
	SYSPRINT	133	133	500	Printed Output
PREPLOT					
	SCNFILE	80	800	2000	Input (sequential)
	INDATA	20	800	2000	Output (sequential)
INMPLOT					
	INDATA	20	800	2000	Input (sequential)
	SYSPRINT	133	133	5	Printed Output
	** depends on installation **				Output to Plotter

been described in Section 5.

Prior to program execution, the standard library NOISLIB and the acoustic data file ACDFIL must be transferred to a direct access storage device. ALTLIB and EXPOREG also require direct access storage. The other files are accessed sequentially within any single program, although some - like SCNFILE - are created by one program and form the input for subsequent programs in the package.

Note that the output to the plotter varies in form from installation to installation, and must be treated as specified by the installation's own user's manual. In some cases the plotter may be driven directly, or output may be spooled for the plotter; in others a file of a certain ddname may be required on disk or on tape. This file is referenced only be the system's own PLOTS subroutine, not by anything in the INMPROG package.

Running time, of course, depends on the speed of the computer. An estimate may be made - usually quite conservative - by using the dollar estimate of Appendix B and assuming it is entirely due to CPU usage. The program should be run at night, because of the heavy demands on the CPU and peripheral storage.

An example of an 'EXEC', or job control program, used to run INMPROG under an IBM VM/CMS time-sharing system, is given in Figure E-1. Clearly this must be modified for each particular installation, although the general sequence of operations would remain the same.

```
&TYPE ENTER JOBNAME -- UP TO 8 CHARS
&READ ARGS
*  &1 TAKES THE VALUE OF JOBNAME
*
*  CHECK FOR PRESENCE OF REQUIRED FILES ON DISK
&ERROR &GOTO -NOFIL
STATE &1 PARMFIL A
STATE &1 RWFILE A
STATE &1 TRKFILE A
STATE &1 MIXFILE A
&ERROR &CONTINUE
*  CHECK FOR DISK WITH LIBRARY ON IT
CP Q V 198
&IF &RETCODE NE 0 &GOTO -NODISK
-CONT1 &CONTINUE
ACC 198 G
&ERROR &GOTO -ERR
*  MAKE PL/I AND PLOTTER LIBRARIES AVAILABLE:
GLOBAL TXTLIB PLIOLIB CALCOMP
*  DEFINE PRINTER FOR ENTIRE JOB:
FILEDEF SYSPRINT PRINTER(PERM RECFM FA LRECL 133 BLOCK 133
&ERROR &GOTO -NOGEN
*  IF AN ALTPROC DOES NOT EXIST, SKIP NOISLIB PORTION
STATE &1 ALTPROC A
&ERROR &GOTO -ERR
*
*
*** GENERATE USER LIBRARY ******** ********
*
FILEDEF ALTPROC DISK &1 ALTPROC A (RECFM FB LRECL 80 BLOCK 800
FILEDEF LIBIL DISK &1 ALTLIB G (RECFM F LRECL 800 BLOCK 800
&A = ACOUSTIC
*&A IS DEFINED SO THAT NEXT LINE IS SHORT ENOUGH FOR EXEC INTERPETER
FILEDEF ACDFILE DISK ACDLIB &A G (XTENT 9999 RECFM F LRECL 558 BLOCK 558
*
NOISLIB
-NOGEN &CONTINUE
*
*
****** MAIN COMPUTATIONAL PROGRAM ******** ********
*
&ERROR &GOTO -ERR
*INPUT FILES:
FILEDEF PARMFIL DISK &1 PARMFIL A (RECFM FB LRECL 80 BLOCK 800
FILEDEF MIXFILE DISK &1 MIXFILE A (RECFM FB LRECL 80 BLOCK 800
FILEDEF RWFILE DISK &1 RWFILE A (RECFM FB LRECL 80 BLOCK 800
FILEDEF TRKFILE DISK &1 TRKFILE A (RECFM FB LRECL 80 BLOCK 800
*LIBRARY FILES:
&L = NOISLIB
FILEDEF &L DISK FAAMOD00 &L G (XTENT 30000 RECFM F LRECL 800 BLOCK 800
FILEDEF ALTLIB DISK &1 ALTLIB G (XTENT 30000 RECFM F LRECL 800 BLOCK 800
*SCRATCH FILE:
&E = EXPOREG
FILEDEF &E DISK FILE &E G (RECFM F LRECL 4000 XTENT 48 BLOCK 4000
*OUTPUT FILE:
```

FIGURE E-1
INM EXEC

AD-A035 062 MITRE CORP MCLEAN VA F/G 20/1

FAA INTEGRATED NOISE MODEL USER'S GUIDE, (U)

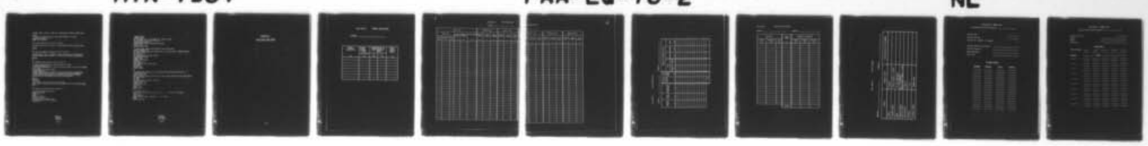
MAR 76 P A MANSBACH, F X MAGINNIS DOT-FA69NS-162

UNCLASSIFIED MTR-7184 FAA-EQ-76-2 NL

2 OF 2

AD

A035062



END

DATE FILMED

3-77

```
FILEDEF SCNFILE DISK &1 SCNFILE G (PERM RECFM FB LRECL 80 BLOCK 800
*
INMII
*  CHECK THAT OUTPUT FILE IS THERE AND DOCUMENT ITS LENGTH
LISTFILE &1 SCNFILE G (D
ERASE FILE EXPOREG G
*
*
*** PRINT TABULAR DATA ******** ********
*
FILEDEF SCNFILE DISK &1 SCNFILE G (PERM RECFM FB LRECL 80 BLOCK 800
*
INMPRT
*
*
*** EXTRACT CONTOURS FROM DATA ******** ********
*
FILEDEF SCNFILE DISK &1 SCNFILE G (PERM RECFM FB LRECL 80 BLOCK 800
FILEDEF INDATA DISK &1 INDATA G (PERM RECFM FB LRECL 20 BLOCK 800
*
PREPLOT
*
*
*** PRODUCE PLOTTED OUTPUT ******** ********
*
*  CHECK PREPLOT OUTPUT FILE AND DOCUMENT ITS LENGTH
LISTFILE &1 INDATA G (D
* THIS INSTALLATION NEEDS A TAPE FOR PLOTTER OUTPUT. SEE THAT IT'S THERE
CP Q V 181
&IF &RETCODE NE 0 &GOTO -TAPE2
-CONT2 &CONTINUE
FILEDEF SCNFILE DISK &1 SCNFILE G (PERM RECFM FB LRECL 80 BLOCK 800
FILEDEF INDATA DISK &1 INDATA G (PERM RECFM FB LRECL 20 BLOCK 800
*THIS INSTALLATION REQUIRES THE FOLLOWING PLOTTER OUTPUT FORMAT:
FILEDEF 36 TAP1 (DEN 800 RECFM VS LRECL 504 BLOCK 508
*
INMPLOT
TAPE RUN
CP DET 181
CP M OP TAPE JUST DETACHED IS TO BE PLOTTED
&TYPE SCNFILE, INDATA, AND ALTLIB ARE STORED ON 198 G. ERASE WHEN DONE.
&EXIT
*
*
*** ACQUIRE DISK SPACE AND GET LIBRARY ***
*
*  DEFINE TEMPORARY DISK 198 G
-NODISK &CONTINUE
&COUNT = 0
&SKIP 1
-AGAIN CP DET 198
&COUNT = &COUNT + 1
CP DEFINE T3330 AS 198 CYL 30
&IF &RETCODE NE 0 &GOTO -NOSPACE
 &STACK YES
```

FIGURE E-1
INM EXEC
(Continued)

```
&STACK DISKG
FORMAT 198 G
&IF &RETCODE NE 0 &IF &COUNT EQ 1 &GOTO -AGAIN
&IF &RETCODE EQ 0 &GOTO -GETLIB
-NOSPACE &CONTINUE
&TYPE CANNOT DEFINE NEEDED DISK SPACE.
&EXIT 1111
-GETLIB &CONTINUE
*
*  READ NOISE LIBRARY AND ACOUSTIC DATA ONTO DISK
&LOOP -ENDLOOP 10
CP M OP PLEASE MOUNT FAA NOISE TAPE AS 181 READ ONLY. PROGRAM WAITS.
CP SLEEP 2 MIN
CP Q V 181
&IF &RETCODE EQ 0 &GOTO -READY1
-ENDLOOP &CONTINUE
&GOTO -ERR
-READY1 &CONTINUE
TAPE REW
TAPE LOAD * * G
&IF &RETCODE NE 0 &GOTO -ERR
TAPE RUN
CP DET 181
&GOTO -CONT1
*
*
*** MOUNT TAPE NEEDED BY THIS INSTALLATION FOR PLOTTER OUTPUT ***
-TAPE2 &CONTINUE
&LOOP -ENDL2 10
CP M OP PLEASE MOUNT SCRATCH TAPE FOR PLOTTER OUTPUT ON DUAL DENS DRIVE
CP SLEEP 2 MIN
Q V 181
&IF &RETCODE EQ 0 &GOTO -READY2
-ENDL2 &CONTINUE
&GOTO -ERR
-READY2 &CONTINUE
TAPE REW
&GOTO -CONT2
&EXIT 111
*
*  ERROR HANDLING
-NOFIL &TYPE A REQUIRED FILE IS MI[illegible] [illegible]OGRAM NOT EXECUTED
&EXIT 100
-ERR &BEGTYPE
ERROR DURING PROCES[illegible]ING. PRO[illegible] TERMINATE
&END
&EXIT &RETCODE
```

FIGURE E-1
INM EXEC
(Concluded)

APPENDIX F

ADDITIONAL DATA FORMS

DATA FORM #1 RUNWAY DEFINITIONS

AIRPORT: ______________________________

RUNWAY IDENTIFIER	RUNWAY ORIENTA-TION (DEG.TRUE)	COORDINATES OF RNWY THRESHOLD (FEET)		RUNWAY LENGTH (FEET)
		X	Y	
(1)	(2)	(3)	(4)	(5)

2

TRACK DEFINITIONS

SEGMENT FIELD 2			SEGMENT FIELD 3			SEGMENT FIELD 4		
NT	LENGTH OR RADIUS (2)	FINAL BEARING (3)	SEGMENT TYPE (1)	LENGTH OR RADIUS (2)	FINAL BEARING (3)	SEGMENT TYPE (1)	LENGTH OR RADIUS (2)	FINAL BEARING (3)

DATA FORM #3 TOTAL TRAFFIC MIX

AIRPORT: ______________________ SCENARIO: ______________________

AIRCRAFT TYPE	GROSS WEIGHT	OPERATIONAL PROCEDURE	AIRCRAFT CODE		NUMBER OF OPERATIONS DAILY				
			LIBRARY	USER CODE	TOTAL		DAYTIME	EVENING	NIGHT
					TAKEOFF	LANDING			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			TOTALS:						

DATÁ FORM #4 TRAFFIC MIX ALLOCATION

AIRPORT: ______________________________ SCENARIO: ______________________________

TRACK CODE			AIRCRAFT CODE	NUMBER OF OPERATIONS		
RUNWAY (1)	IDENTIFIER (2)	TYPE (3)	(4)	DAYTIME (5)	EVENING (6)	NIGHTTIME (7)
			TOTALS:			

DATA FORM #5 USER OPTIONS

AIRPORT: ____________________ SCENARIO: ____________________

OPTION	DEFAULT VALUE	DESIRED VALUE IF DIFFERENT
TITLE	(blank)	
PLOTTER SCALE	2000 FT/INCH = 1:24000	
BASE	85 dBA THRESHOLD	
CONTOUR LEVELS	0, 2, 15 MINUTES (65,75 Ldn if BASE = 'LDN')	
GRID SPACING	3000 FT	
AMBIENT	0 L_{dn}	
AIRCRAFT CODES	LIBRARY ONLY	

DATA FORM #6 - PROFILE DATA

Alternate Noise Library Identifier: ____________

Aircraft code ____________

Acoustic data code ____________

Operation (T = takeoff, L = landing) __

Procedure description (optional) ____________

Aircraft (optional) ____________

Engine (optional) ____________

Power units ____________

Procedure Profile

Downrange	Altitude	Power	Velocity

DATA FORM #7 - ACOUSTIC DATA

Alternate Noise Library Identifier: ____________________

Acoustic data code ____________

Aircraft ____________________

Engine ____________________

Power units ____________________

Noise Curves

Power settings ______ ______ ______ ______ ______

______ ______ ______ ______ ______

Distance	Level				
______	______	______	______	______	______
	______	______	______	______	______
______	______	______	______	______	______
	______	______	______	______	______
______	______	______	______	______	______
	______	______	______	______	______
______	______	______	______	______	______
	______	______	______	______	______
______	______	______	______	______	______
	______	______	______	______	______
______	______	______	______	______	______
	______	______	______	______	______
______	______	______	______	______	______
	______	______	______	______	______
______	______	______	______	______	______
	______	______	______	______	______
______	______	______	______	______	______
	______	______	______	______	______
______	______	______	______	______	______
	______	______	______	______	______